Call-A.P.P.L.E.™

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Keeping Your Computer on Time

INSIDE:

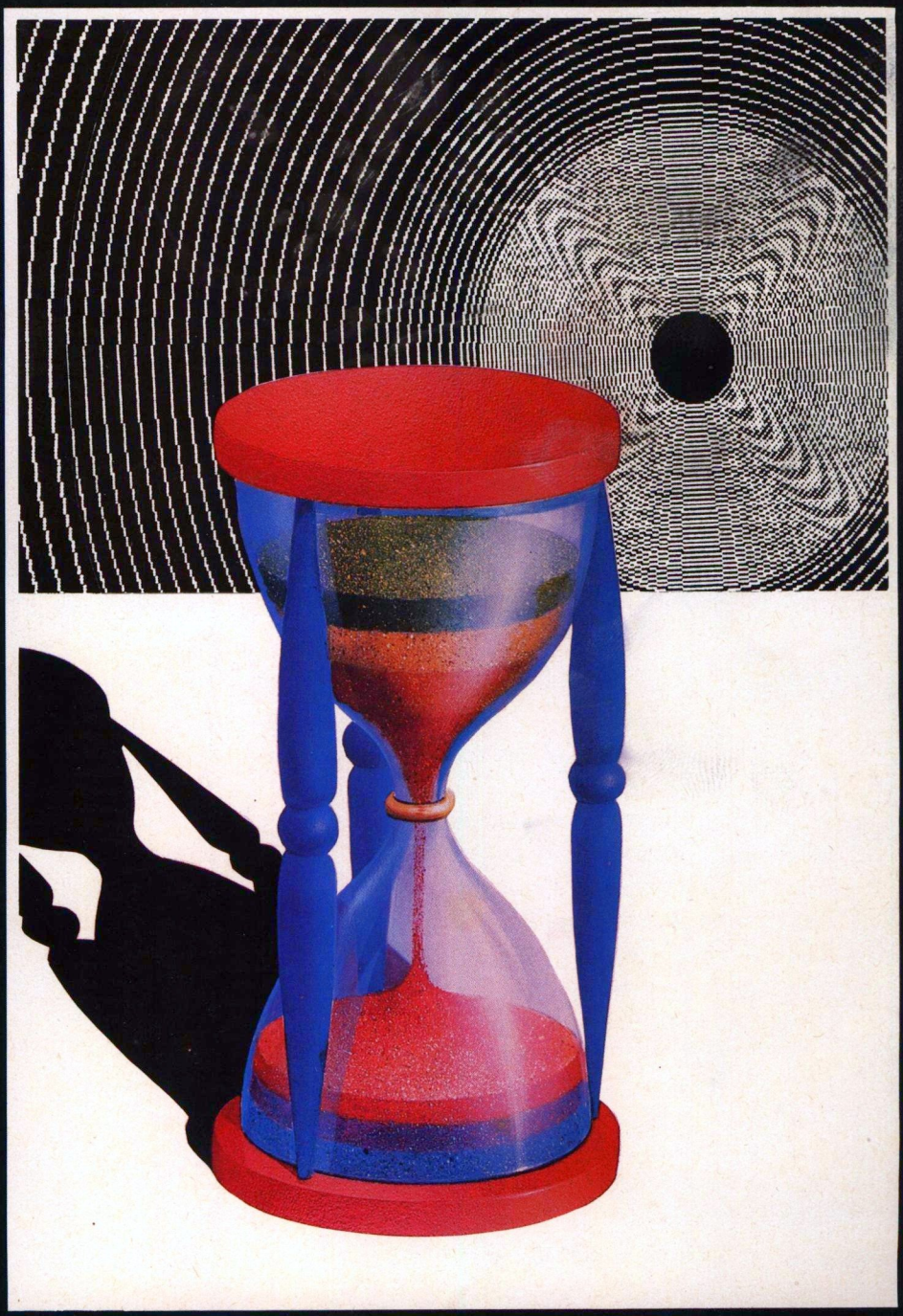
- Setting ProDOS Time
- Computing Day-of-Week for Any Date
- Applesoft Error Filter
- Spreadsheet Review: "SuperCalc3a"

MACINTOSH:

- Microsoft's "Excel" – New King of Spreadsheets?

PLUS:

- Inside the Mach 3.5 Accelerator Card
- Helpful Hardware and Software Hints
- New Products from Apple, and more. . .



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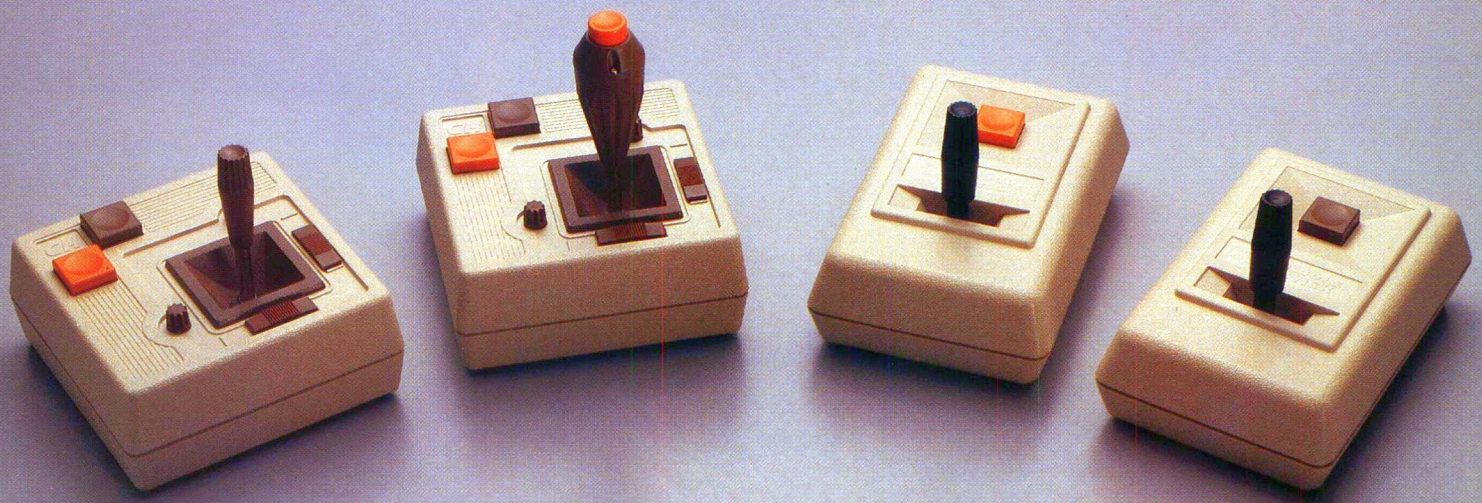

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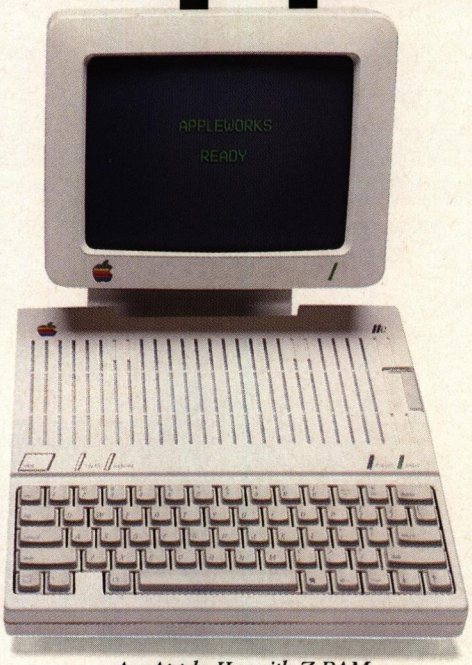
An Apple IIc



An Apple IIc with Z-RAM

The Apple IIc on the right works exactly the same as the Apple IIc on the left. Almost. The Apple on the right has a powerful memory expansion coprocessing card called Z-RAM. From Applied Engineering. Which means the Apple on the right can completely load AppleWorks into RAM—and then run it up to thirty times faster than the Apple on the left.

Z-RAM also acts as a solid-state disk drive. Which means the Apple on the right will load and store programs up to 30 times faster. And, our included RAM disk is compatible with Applesoft, PRO-DOS, DOS 3.3, PASCAL and CP/M.

Turbo Charged AppleWorks.

Even a 256K Z-RAM can completely load AppleWorks into RAM. With Z-RAM, the moment your fingers touch the keyboard AppleWorks responds. A 256K Z-RAM lets your IIc run AppleWorks up to 30 times faster, increases available desktop to 229K and maximum number of records from 1,350 to over 16,000, doubles the number of lines allowed in the word processor, provides a print spooler, and auto-segments large files so they can be saved on two or more disks. A 512K Z-RAM boosts AppleWorks desktop to an incredible 413K.

Take a closer look.

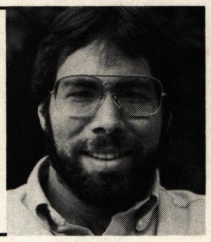
There's more. Z-RAM has a built-in high speed Z-80B microprocessor that allows you to run CP/M programs. Which means you now have access to the single largest body of software in existence, including popular packages like WordStar, dBase II, Turbo PASCAL and Microsoft BASIC.

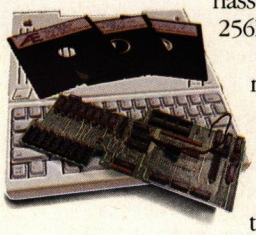
And still more. Z-RAM is compatible with all IIc software and hardware, installs easily in just ten minutes with a screwdriver (slightly longer without), is available with 256K or 512K of additional memory (a 256K Z-RAM can be upgraded to 512K at any time). Z-RAM is easily handled by the IIc power supply with our patent pending power saving design.

The only thing better than that would be a recommendation from Steve Wozniak.

"I recommend Applied Engineering products wholeheartedly." (Of course, Steve's IIc has a Z-RAM installed.)

Steve Wozniak, the creator of Apple Computer.





For fast response.

Z-RAM comes complete with simple instructions, RAM disk software, Z-80 operating system, CP/M manual. And a five year "hassle free" warranty. Make a good Apple great. With 256K Z-RAM ($399); or with 512K ($479).

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Call-A.P.P.L.E.™

November 1985 Volume 8, Number 10

Official Publication of **A.P.P.L.E. Co-op** "People Helping People with Personal Technology".

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Whether flowing through this colorful hourglass as sand, or splitting milliseconds in a MPU chip, silicon plays a vital role in the precise measurement of time. Illustration by Ron Keister and Mary Hubert.

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The INNER CIRCUIT

Don Elman

Programming for Time

Along with the complexity of its myriad, binary logic circuits, the microcomputer's unique functionality depends on its ability to keep time precisely—splitting seconds into thousands, millions, even billions of parts. Because of its natural tendency to compress hours into microseconds, the computer often must be purposely programmed to space out its actions, slowing its operations to what we humans consider "real time".

Unlike other computers (such as the Macintosh) that are equipped with battery operated clocks to keep in perpetual synchronization with real-world time standards, the basic Apple II can, at best, only measure time relative to each new power-up. Several hardware and software solutions have become available to augment this limitation, from clock cards to calendar programs.

In This Issue

Our first timely feature this month, **Setting ProDOS's Time and Date** by Wes Felty, explores how ProDOS stores human time referents in its memory. Following that is Cecil Fretwell's **Date Calendar**, which includes a program for calculating any conceivable date. **An Error Filter, or The Clean Error Act of 1985**, by Ken Kashmarek, presents a valuable time-saving utility for assembly-language programmers who would like to trap those errors sooner rather than later.

We also have the second part of Dave Lingwood's excellent description of the Mach 3.5 speed-up card, with plenty of technical details, and Jeffrey Jacques' review of SuperCalc3a in comparison to the venerable THE Spreadsheet. Our special Macintosh focus is a solid review by Richard Loggins of Microsoft's eagerly-awaited answer to Jazz, "Excel." All this, plus our regular letters and new-products departments, should help you pass the time in a most enjoyable and informative way.

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APPLEWORKS ENHANCEMENTS

Read why Applied Engineering
is the acknowledged leader in AppleWorks enhancements

- Applied Engineering was first to expand Appleworks beyond 55K.
- Applied Engineering was first to eliminate disk access on Drive 1 in Appleworks, thereby dramatically speeding up the program and reducing disk drive wear.
- Applied Engineering was first to expand AppleWorks to 1 megabyte of memory.
- Applied Engineering was first to expand AppleWorks to 3 megabytes.
- Applied Engineering was first to provide auto segmenting on large files so any size file can be saved on regular floppies.
- Applied Engineering was first to increase the maximum number of records in the data base from 1350 to 16,300.
- Applied Engineering was first to increase the number of lines in the AppleWorks word processor from 2250 to 16,300.
- Applied Engineering was first to display the time and date on the AppleWorks screen.
- Applied Engineering was first to provide auto dating as part of the data base field.
- Applied Engineering was first to provide auto time stamping as part of the data base field.
- Applied Engineering was first to include a built-in print spooler for AppleWorks. So you're back in AppleWorks in 10 seconds not 10 minutes.

With all of these firsts, it's no wonder most people choose Applied Engineering when they want enhancements to Appleworks. Especially when you consider that nearly all the "firsts" listed above are "onlys" too. And our Appleworks enhancements are as easy to use as inserting a disk and pressing return because all enhancements are merged with the AppleWorks program disk and stay there out of sight until needed, only now AppleWorks will run up to 20 times faster, and be easier to use at the same time.

And we're working on new improvements to AppleWorks all the time, so the few remaining criticisms the software reviewers gave AppleWorks will vanish forever. So if you want more out of AppleWorks, order RamWorks II™ and Timemaster H.O.™ for the IIe or Z-RAM™ and IIc System Clock™ for the IIc. You'll find specifications and prices for these products listed in this magazine. Please look for Applied Engineering in the advertiser's index.

There's no question about how they'll increase your productivity. The only question you'll have is how you ever got along without them.

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NOVEMBER 1985

Don Elman

Holiday Discount Coupon

Elsewhere in this issue you'll find a valuable 10% discount coupon good through December 1, 1985. This can be applied to any order for products sold by A.P.P.L.E. Co-op, and may even be used for several products ordered at the same time. However, since the coupon itself must accompany the order, it can only be used for mail orders or in-store purchases. *Non-members*, remember that you may place one order with us before joining the Co-op.

Although the coupon is good through November, we remind you that ordering early will avoid the holiday rush. Also, as supplies of certain products are limited, items in stock will be shipped on a first come - first served basis.

Our main office business hours through December 31st are: Monday - Friday, 8:30 AM - 4:00 PM, Pacific time, except for Thanksgiving and Christmas Day. Retail store hours are: M-F, 11 AM - 5 PM, and Sat., 11 AM - 3 PM. (We are happy to announce that there are no plans whatsoever to move our offices again this year.)

Great A.P.E. Contest Extended

Now that A.P.E. Pro (Applesoft Program Editor, ProDOS version) is available from A.P.P.L.E. Co-op, we have decided to extend the deadline for the Great A.P.E. QuickType Contest to November 30, 1985. So you still have time to apply your skills at creating macro-like functions to use with A.P.E. For details, look in the June 1985 *Call -A.P.P.L.E.*, or call our Hotline.

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A.P.P.L.E. Co-op has always offered one of the most liberal return policies in the industry—100% credit for any product returned within 15 days for any reason, as long as you call us first for a "return authorization number." Also, a full refund or bank card credit has been available upon written request for products over $100, if returned within the 15-day period.

In order to keep prices as low as possible for everyone, we have been forced to make a partial change in this policy, effective October 1, 1985. *Software can be returned only in exchange for credit toward other products, but not for a direct refund.* The older refund policy will still apply to hardware and publications, if returned in good condition with all warranty cards, documents, and original packaging intact. We trust that members will understand the necessity of this policy change.

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There is another, even less pleasant type of return that occasionally comes up—checks that are returned from the bank due to insufficient funds. Please be advised that members' and customers' accounts are subject to a $12.00 processing fee for each NSF check we receive.

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Among all our categories of membership, the most prestigious is the Corporate Membership. At $250 per year, a company will receive 5 membership cards, 5 subscriptions to *Call -A.P.P.L.E.*, access to services for additional employees, eligibility to use purchase orders, and bulk rate discounts on such products as diskettes. This type of membership is limited to the U.S.A.

Reading Winner

Congratulations this month to Jeffrey P. Utz of Moscow, PA, whose Reader's Choice card was drawn at a recent meeting.

A.P.P.L.E. Consultants

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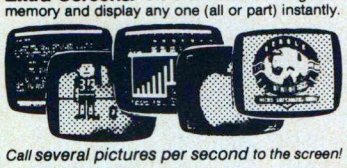

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```
10 PRINT CHR$(21): COLOR=2:
   FOR X=0 TO 39 STEP 2: FOR Y=1
   TO 47 STEP 2: Z=Z=0: PLOT
   X+Z,Y: NEXT Y,X
20 POKE 37,255
```

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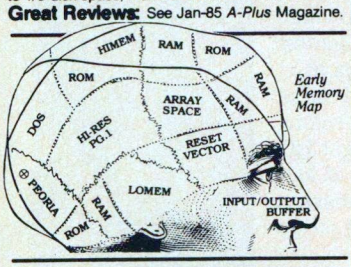

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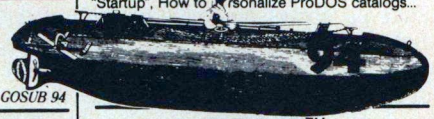

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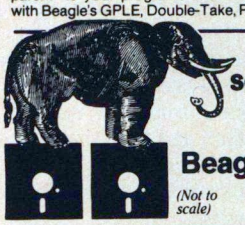

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```
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1 FOR X=1 TO 15
2 S=PEEK(49200+00000): NEXT
3 N=INT(RND(1)*5)+48
4 POKE 2075,N: POKE 2081,100-N
5 VTAB 9: LIST 1-2: GOTO 1
```

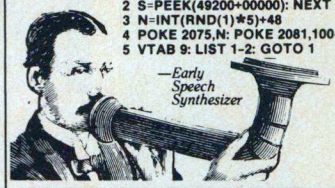

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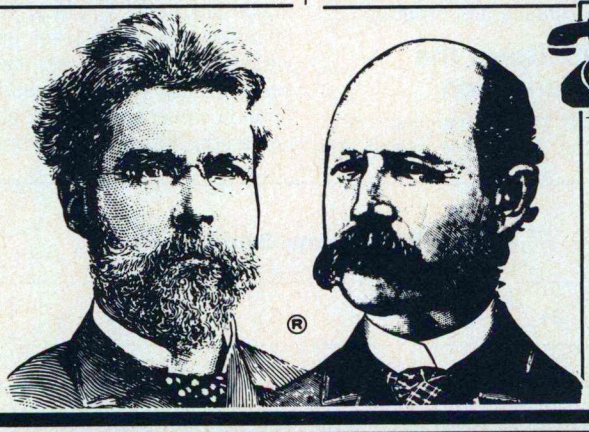

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Setting ProDOS's Time and Date

Wes Felty

It is nice that ProDOS gives a time and date stamp on its disk files showing when they were created and/or modified. But, unfortunately, ProDOS doesn't give a very good way to set the Time/Date stamp if you don't have a ProDOS compatible clock card installed. You can use the time option on the ProDOS master disk, but that is hardly a decent solution when you are developing a new program and periodically saving it. If you wanted to keep the time updated, you would have to keep rerunning the "STARTUP" program from the master disk to update the time; and then the time that would be stored on the disk files would indicate when the program was started, but not when it was finished.

This article will show how the Time/Date is read from memory, set, and stored in memory. Also, a program subroutine will be developed that you can add to your programs to reset the Time/Date stamp. And finally, I'll show you how to quickly and easily POKE the time into memory without running any program.

How ProDOS Stores the Time/Date Information

ProDOS needs to store five pieces of information for the Time/Date stamp, the hour, minute, day, month, and year. Let's see what the most compact way to store these five numbers would be. We may be able to store them in less than five bytes of memory. So, here we need to relate the binary numbers used by the computer itself to the hex bytes used by the programmer. Figure 1 shows the value of each of the eight bits in a hex byte. The value of 256 is shown to the left, illustrating what the value of a ninth bit would have been since the entire byte could have a value of one less then that when all of its bits are turned on (ones). Therefore, 11111111 = 255. Similarly, 11111 = 31 since the sixth bit on would have been 32, and five ones is one less for a value of 31.

How many bits and bytes are needed for our Time/Date data? We can find out by using Figure 1, looking for the largest number less than the number needed. Hours has a maximum value of 24, so it will need five bits. Minutes has a maximum value of 60, so it will need six bits. Months, at 12 maximum, needs four bits. Days, at 31 maximum, needs five bits. And the year, at 99 maximum, needs seven bits. Therefore, we have 27 bits to store; and at eight bits per byte, this will take a minimum of four bytes however we do it. We also will have to spread the information for one of the pieces

Figure 1 Hexadecimal Byte's Bit Values

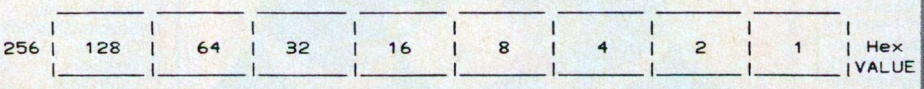
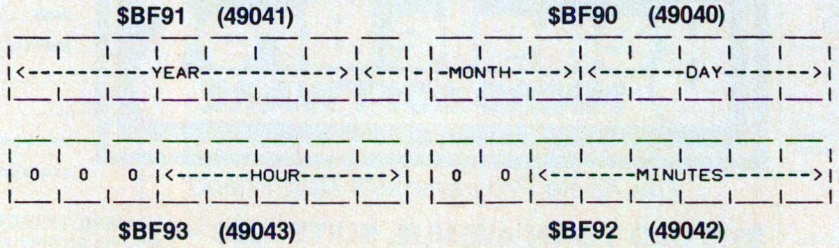


Figure 2 Time/Date Data Storage in RAM Memory



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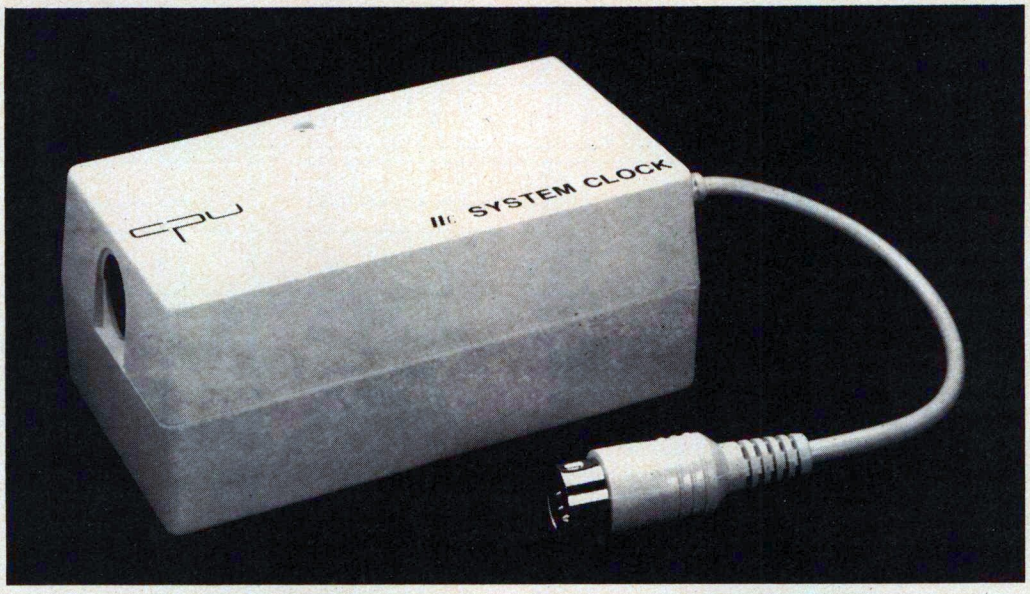

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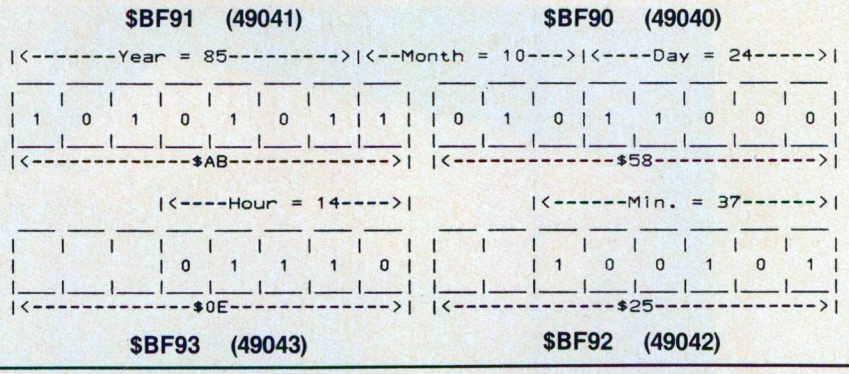
of data over two bytes. The month information is what gets split. ProDOS stores this Time/Date data in the four bytes of RAM memory starting at $BF90 (49040) as shown in Figure 2. Notice that the Low Byte and High Byte are reversed in order as in hexadecimal addresses.

Let's look at an example, a time of 2:37 PM on October 24, 1985. Since it is 2 PM, the hour is 2 + 12 = 14 hours on a 24 hour clock scale. 14 in hex is $0E. The time of 37 minutes is $25. Notice in Figure 3 that the bytes at $BF92 and $BF93 (49042 & 49043) are just the hex values for the minutes and hours respectively.

The date is trickier because three pieces of data are spread over two bytes. Again refer to Figure 3 to see how October 24, 1985 becomes $58 $AB. Therefore, the date and time of 2:37 PM on October 24, 1985 are stored in memory as $58 $AB $25 $0E starting at $BF90 (49040). The information is stored in the ProDOS catalog on disk in exactly the same way starting at the 25th byte of the catalog entry for the Time/Date created and the 34th byte for the Time/Date last modified.

It is quite easy to update the time for ProDOS since we just need to POKE the decimal value of the minutes at 49042 and the hour on the 24 hour scale at 49043. But the date is complex enough to need a program to handle it. Once this program is written and saved to disk, it can be loaded first whenever a new program is being written and activated with a GOTO "starting line number" whenever you wish to update the Time/Date before saving a version of the program under development. After the program is completed, this subroutine can be deleted if it is not needed.

Figure 3 Time/Date Bits & Bytes for 2:37 PM, October 24, 1985



Unpacking the Date Data From the Two Bytes

If you look at line 60010 in Listing 1, 'TIME.DATE.STAMP," you will see that it is easy to read the time from the Time/Date Stamp. Just "PEEK (49043)" for the hour and "PEEK (49042)" for the minutes. But line 60040 for PEEKing the date is much more complex. To understand how to unpack the three pieces of data from the two bytes of 49040 and 49041, you have to know how to change hex numbers by moving its binary bits to the right or to the left. Looking back to Figure 1, notice that going to the left, each bit has a value twice as big. And, going to the right, each bit has a value one half the original bit. Therefore, to shift all of the bits one place to the left, you would multiply the byte's value by two. This is called a Logical Shift Left, "LSL." The leftmost original bit would be just thrown away. Similarly, to shift each bit to the right you would divide the original byte's value by two. This Logical Shift Right, "LSR," loses the original right hand

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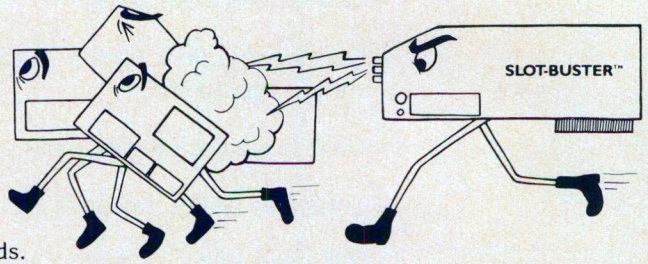

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bit. For our arithmetic to make the right hand bit disappear, we need to use the "INT ()" function. To shift all of the bits five places to the right, you would need five LSR's and therefore would divide by 2 M 5 or 32 and use the INT ( ) function on it to drop out the original right three bits (INT (Y/32)).

Now, to unpack the date data, look at Figure 2. Notice that to recover the year, we just need to take the value PEEKed from 49041, called DH (Date High byte) in line 60040, and shift all of its bits one place to the right. Therefore, YEAR = INT (DH / 2).

To get the month, we need to Logical Shift Right 5 places the value PEEKed from 49040, DL (Date Low byte) and add to it the rightmost bit of DH. INT (DL / 32) will do the LSR to DL. Then to get the rightmost bit of DH, we can subtract 2 * YEAR (the 2 is for a Logical Shift Left to put the year data back into the leftmost seven bits) from DH. Since the difference represents the fourth bit to the left of the month, we have to multiply it by eight. Therefore, MONTH = INT (DL / 32) + 8 * (DH - 2 * YEAR).

Finally, to get the day, we need to subtract from DL the value of the left three bits. We need to LSR them five places, get their value and then LSL them 5 places back. Therefore, DAY = DL - 32 * (INT (DL / 32)). That's it. Simple wasn't it? No! Simple it wasn't! That's why I wrote this article in the first place. POKEing the values back into memory after entering or changing them is very similar, but a little simpler. Look at line 60330 in the program listing. Did you see the MONTH, M, being logically shifted five places left (32 * . . .) after it was logically shifted right three places and then back left three places, (8 * INT (M / 8)). The LSL five places put the lowest three bits of the month into the highest three bits of DL. The LSR and LSL of three places got rid of the leftmost bit of the month so that its three low bits could be moved over and added to DAY, D, to get DL to POKE back into 49040.

For DH, we just need to LSL the YEAR, Y, one place or 2 * Y and add in the high bit from the month. The month's high bit will be zero if month is less than eight or one if it is eight or more (the 4th bit from the right has a value of eight and months only go up to 12). Therefore, we just need to add one to DL if the month is greater than seven, so the Boolean expression, "(M > 7)," will be zero if M < 8 or one if M > 7.

Using TIME.DATE.STAMP

Just BOOT up ProDOS, type in Listing 1, save it to disk, and use it as a subroutine or a stand alone program. The easiest way to use it as a subroutine is to load it first before writing the other program. If you don't have a merge program to merge it into your present ProDOS programs, see the

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section below, "EXEC Merging of Programs." Just use GOSUB 60000 to activate it.

To use TIME.DATE.STAMP, just enter the data in the format shown. Precede one digit numbers with a zero. You may press the RTRN key at any time to keep the data shown. And, you may press the ESC key at the beginning of the time entry or the date entry to leave the subroutine, leaving the rest of the data intact. For Afternoon times, use a 12 hour scale and "P" or "p" for "PM." ProDOS stores the time and writes it to disk as 24 hour time, but TIME.DATE.STAMP converts it to 12 hour time with "AM" or "PM." If you wish to update the time (without the date), you can "POKE 49043, HOUR" and "POKE 49042, MINUTES" where HOUR is in 24 hour time (2:37 PM would be HOUR = 14, MINUTES = 37).

EXEC Merging of Programs

One easy way to merge one program into another is to capture it in a text file (or write it on a text processor) and then LOAD the first program and EXEC the program to be merged with it. The EXEC command reads the text file off of the disk drive into memory just as if you were typing it in immediate mode. So you don't want the same line numbers in the original and merged programs. The lines that are from the EXEC file will replace the original lines when they both have the same line numbers, just as if you were typing in the second program after LOADing the original one. Add the following four lines on the program that you want to merge and RUN it. It will create a text file, "MERGE.TIME.DATE." LOAD the program that you want to merge TIME.DATE onto and "EXEC MERGE.TIME.DATE." Add the command "GOSUB 60000" wherever you want to run the subroutine and save the new merged program. That's it!

```
MERGE.TIME.DATE
0 PRINT CHR$ (4)"OPEN
  MERGE.TIME.DATE": PRINT
  CHR$ (4)"WRITE
  MERGE.TIME.DATE"
1 LIST 60000, 61000
2 PRINT CHR$ (4)"FLUSH": PRINT
  CHR$ (4)"CLOSE"
3 END
```

Listing 1

```
TIME.DATE.STAMP

60000  REM   DATE AND TIME SET
60010 HOUR =  PEEK (49043):MIN =  PEEK (49042):MIN$ = "0" +  CHR$
      (176 + MIN): IF MIN > 9 THEN MIN$ =  CHR$ (176 +  INT (MIN /
      10)) +  CHR$ (176 + (MIN - 10 *  INT (MIN / 10)))
60020 AP$ = "AM": IF HOUR >  = 12 THEN AP$ = "PM":HOUR = HOUR - 12
60030 HOUR$ =  STR$ (HOUR): IF HOUR < 10 THEN HOUR$ = "0" + HOUR$
60040 DL =  PEEK (49040):DH =  PEEK (49041):YEAR =  INT (DH / 2):MNTH
      =  INT (DL / 32) + 8 * (DH - 2 * YEAR):DAY = DL - 32 * ( INT
      (DL / 32))
60050 MNTH$ =  STR$ (MNTH): IF MNTH < 10 THEN MNTH$ = "0" + MNTH$
60060 YEAR$ =  STR$ (YEAR):DAY$ =  STR$ (DAY): IF DAY < 10 THEN DAY$
      = "0" + DAY$
60070  TEXT : HOME : PRINT "CURRENT DATE AND TIMES ARE"
60080  VTAB 4: PRINT "TIME";: HTAB 7: PRINT HOUR$":"MIN$"   "AP$;:
      HTAB 25: PRINT "HH:MM   AM OR PM"
60090  VTAB 8: PRINT "DATE";: HTAB 7: PRINT MNTH$"/"DAY$"/"YEAR$;:
      HTAB 25: PRINT "MM/DD/YY
60100  VTAB 14: HTAB 1: PRINT "ENTER NEW DATA OR PRESS 'ESC' TO END":
      VTAB 4
60110  HTAB 7: GET T1$: IF T1$ =  CHR$ (13) THEN H = HOUR: GOTO 60150
60120  PRINT T1$;: IF T1$ =  CHR$ (27) THEN  RETURN
60130  IF  VAL (T1$) > 1 THEN  PRINT  CHR$ (7);: GOTO 60110
60140  GET T2$: PRINT T2$;:H = 10 *  VAL (T1$) +  VAL (T2$): IF H >
      12 THEN  PRINT  CHR$ (7);: GOTO 60110
60150  HTAB 10: GET T3$
60160  IF T3$ =  CHR$ (13) THEN M = MIN: GOTO 60190
60170  PRINT T3$;: IF  VAL (T3$) > 5 THEN  PRINT  CHR$ (7);: GOTO
      60150
60180  GET T4$: PRINT T4$;:M = 10 *  VAL (T3$) +  VAL (T4$): IF M >
      59 THEN  PRINT  CHR$ (7);: GOTO 60150
60190  HTAB 15: GET T5$: PRINT T5$;: IF T5$ <  > "A" AND T5$ <  > "a"
      AND T5$ <  > "P" AND T5$ <  > "p" AND T5$ <  >  CHR$ (13) THEN
      PRINT  CHR$ (7);: GOTO 60190
60200  IF T5$ =  CHR$ (13) THEN T5$ = AP$
60210  IF T5$ = "P" OR T5$ = "p" OR T5$ = "PM" THEN H = H + 12
60220  POKE 49042,M: POKE 49043,H
60230  VTAB 8: HTAB 7: GET D1$: IF D1$ =  CHR$ (27) THEN  RETURN
60240  IF D1$ =  CHR$ (13) THEN M = MNTH: GOTO 60270
60250  PRINT D1$;: IF  VAL (D1$) > 1 THEN  PRINT  CHR$ (7);: GOTO
      60230
60260  GET D2$: PRINT D2$;:M = 10 *  VAL (D1$) +  VAL (D2$): IF M >
      12 THEN  PRINT  CHR$ (7);: GOTO 60230
60270  HTAB 10: GET D3$: IF D3$ =  CHR$ (13) THEN D = DAY: GOTO 60300
60280  IF  VAL (D3$) > 3 THEN  PRINT  CHR$ (7);: GOTO 60270
60290  PRINT D3$;: GET D4$: PRINT D4$;:D = 10 *  VAL (D3$) +  VAL
      (D4$): IF D > 31 THEN  PRINT  CHR$ (7);: GOTO 60270
60300  HTAB 13: GET D5$
60310  IF D5$ =  CHR$ (13) THEN Y = YEAR: GOTO 60330
60320  PRINT D5$;: GET D6$: PRINT D6$;:Y = 10 *  VAL (D5$) +  VAL
      (D6$)
60330  POKE 49040,32 * (M - 8 * ( INT (M / 8))) + D: POKE 49041,(2 *
      Y + (M > 7))
60340  RETURN
```

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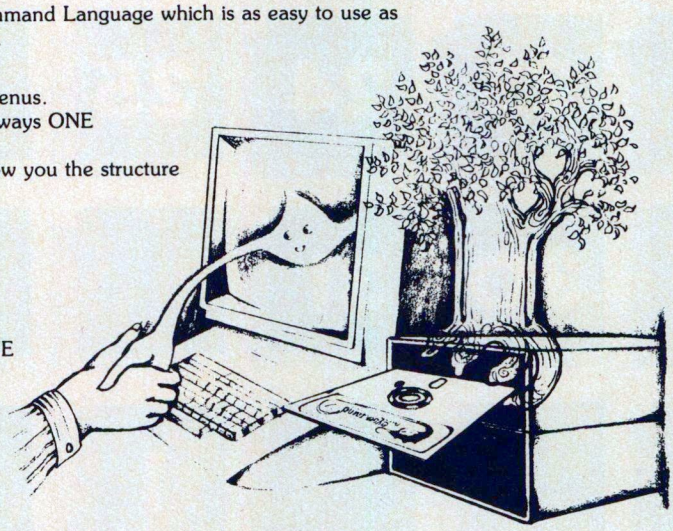

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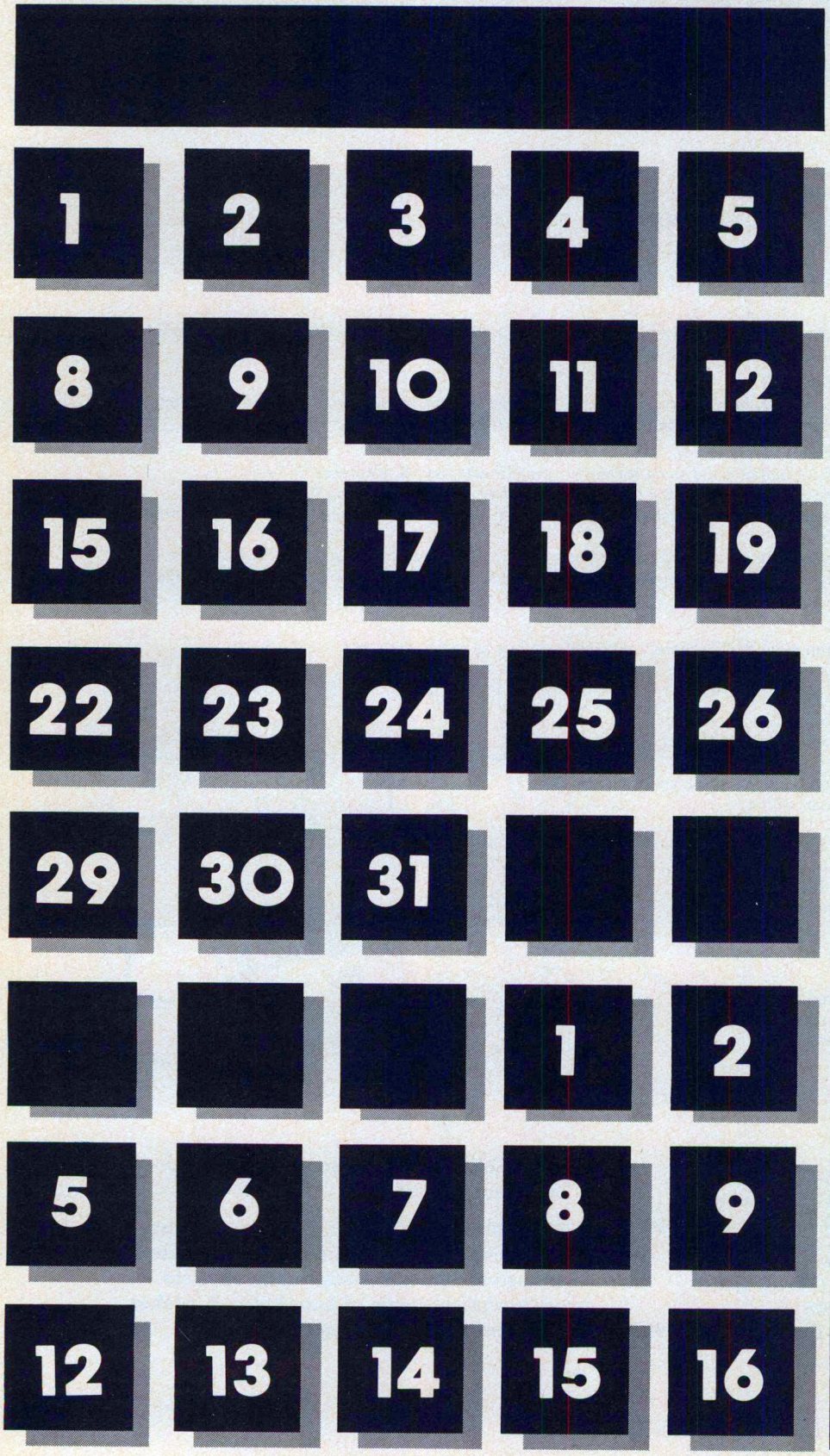
Date Computer



Cecil Fretwell

IF you don't already know, would you like to know the day of the week you were born? Or is your wife a genealogist like mine and recently wanted to know the day of the week for an ancestor's birth or death? Would you like to jazz up a menu with the current date, time, and day of the week? Read on to see how to compute the day of the week given a calendar date.

If you own a *//*e with a Thunderware, Prometheus, or Mountain Hardware clock card, the code to obtain such information is trivial. For my Prometheus card, the program in Listing 1 does the job.

PROGRAM TO READ PROMETHEUS VERSACARD FOR DATE AND TIME

```
100 REM
110 REM
120 REM
130 REM
140 REM
150 REM
160 D$ = CHR$ (4)
170 PRINT D$"PR#4"
180 PRINT D$ "IN#4"
190 INPUT "%";T$
200 INPUT "/";Y$
210 PRINT D$"PR#0"
220 PRINT D$"IN#0"
230 PRINT Y$;" ";T$
```

Simply RUN this program and obtain something like

1985 WED JUN 12 08:35:01 PM

Or a simple LEFT$(T$,3) gives you the day of the week you desire. Given a date other than the current date active in the card, to obtain the desired day of the week, you would have to temporarily set your clock up for the desired date, obtain the desired day, then reset your clock back to the current date. Add to this the possibility that you have a *//*c without a clock makes my algorithm very desirable.

Actually, I did not develop the formula for the algorithm; it is a formula I found many years ago and tucked it away in my "nice to know" file. The formula is as follows: .LI0 .PM0

$$N = D + 2*M + [3*(M+1)/5] + Y + [Y/4] - [Y/100] + [Y/400] + 2$$

On the right hand side of the equals sign, D is the numeric day in the month. M is the number of the month in a year, with the qualification that January and February are counted as the 13th and 14th months,

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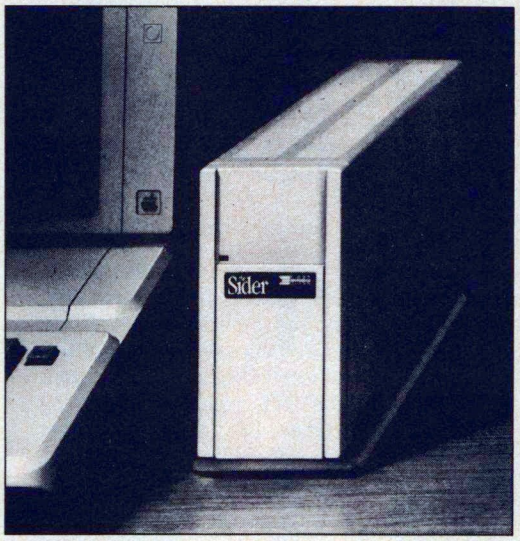

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respectively, of the preceding year. Y is the year expressed as a four-digit number such as 1985. Again note the January and February interpretation. For example, if you are working with February 13, 1985, then M for the formula is 14 and Y is 1984. Other months such as June retain their natural number, 6 in this example.

In the formula, note the use of the [and] around computations. They mean compute the value bracketed and retain only the integer part of the result, i.e., throw away everything after the decimal point. As you will see, the INT function in Applesoft provides the necessary tool for this.

Given this formula, compute N. For something like 11 June 1985, N will be 2495. Divide N by 7 and retain only the remainder. Dividing 2495 by 7 yields a remainder of 3. A remainder of 0 is Saturday, a remainder of 1 is Sunday, etc. In the example, 3 is Tuesday.

The Applesoft code to perform the computations is really rather simple as demonstrated by the program in Listing 2.

PROGRAM TO COMPUTE DAY OF THE WEEK FOR A GIVEN DATE

```
100 REM
110 REM
120 REM
130 REM
140 REM
150 REM
160 InPUT "ENTER DAY NUMBER:";D
170 INPUT "ENTER MONTH NUMBER:";M
180 INPUT "ENTER YEAR NUMBER:";Y
190 IF M    2 THEN 220
200 M = M + 12
210 Y = Y - 1
220 N = D + 2*M + INT (M + 1)*6/10
      + .05) + Y + INT (Y/4 + .05)
230 N = N - INT (Y/100 + .005) + INT
      (Y/400 + .005) + 2
240 R = N - 7 * INT (N/7 + .005)
250 IF R = 1 THEN D$ = "SUNDAY"
260 IF R = 2 THEN D$ = "MONDAY"
270 IF R = 2 THEN D$ = "TUESDAY"
280 IF R = 2 THEN D$ = "WEDNESDAY"
290 IF R = 2 THEN D$ = "THURSDAY"
300 IF R = 2 THEN D$ = "FRIDAY"
310 IF R = 2 THEN D$ = "SATURDAY"
320 PRINT "THE DAY OF THE WEEK
    IS ";D$
330 END
```

After the month, day, and year are input in Lines 160 to 180, Lines 190 to 210 take care of the January and February quirk. Then Lines 220 and 230 compute N for the formula. Especially note the use of the constant .005 inside the INT arguments. Floating point arithmetic has the habit of producing something like 4.999995 instead of 5, a quirk which would throw a wrench in the works.

Line 240 computes the remainder of N divided by 7. The result of this operation, R, tells us the day of the week for the given date. Lines 250 to 310 serve as a table to convert the numeric remainder into a more recognizable form.

There is one more possibility to cover. Suppose you are working with ProDOS and have a clock card such as the Prometheus Versacard. You don't want to fight the hassle of entering the date and time from the keyboard or messing up your nice 80 column display by messing with PR# and IN# to get to the clock then having PR#3 clear your nice screen. Let ProDOS and Applesoft do the job for you as shown in the following program.

PROGRAM TO UPDATE ProDOS GLOBAL PAGE DATE AND TIME THEN CONVERT GLOBAL PAGES TO PROPER NUMERIC VALUES

```
100 REM
110 REM
120 REM
130 REM
140 REM
150 REM
160 REM
170 REM
180 DATA 32,0,191,130,0,0,96
190 FOR I = 768 TO 768 + 6
200 READ P
210 POKE I,P
220 NEXT
230 CALL 768
240 DH = PEEK (49041)
250 DL = PEEK (49040)
260 HR = PEEK (49043)
270 MI = PEEK (49042)
280 Y = DH / 2
290 T = INT (DL / 32 + .005)
300 M = (DH - Y * 2) * 8 + T
310 Y = 1900 + Y
320 D = DL - T * 32
330 PRINT Y,M,D,HR,MI
```

Lines 180 to 220 poke a short assembly language program which uses the Machine Language Interface to set the current date and time from the clock card. Line 230 calls this short assembly language program. I used the common 768 area for this, you can use any convenient area of memory merely by changing the references to 768 in Lines 190 and 230 to what you desire.

The results of Lines 240 to 320 produce the year, month, and day required for the formula given above. They also produce the hour in HR and the minute in MI. The hour will be in military notation, e.g., an HR of 22 is 10 P.M. Line 330 lets you check your work.

If you are interested in the date only, Lines 180 to 230 are not necessary if you don't expect to have your program active under conditions where you work past midnight. When you boot your system, the global page date and time will reflect when you booted your system and will not change until you write something to disk or use the code given in Lines 180 to 230. If you have a //c, this does not apply and one must assume you will execute the necessary program to update the global page date and time.

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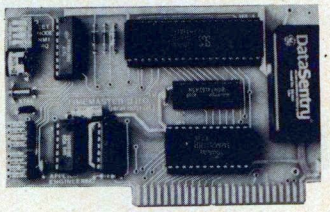

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BRAND C	NO	NO	NO	NO	NO	NO	NO	NO
BRAND M	NO	NO	NO	NO	NO	NO	NO	NO
BRANDP	YES	YES	NO	YES	NO	NO	NO	NO
BRAND S	NO	NO	NO	YES	NO	NO	NO	NO
BRAND T	YES	NO	NO	NO	NO	NO	YES	NO

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VISION 80	MORE	YES	NO	NO	YES	NO	NO	NO
OMNIVISION	MORE	NO	NO	NO	NO	NO	YES	YES
VIEWMAX 80	MORE	YES	NO	NO	YES	NO	NO	YES
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An Error Filter

or The Clean Error Act of 1985

Ken Kashmarek

DO you know what an air filter does for a car engine? Of course. It removes dirt for longer engine life and more reliable operation. A breathing mask can provide the same function for your lungs. What does that have to do with your Apple? It turns out there are software filters in your Apple. How can you use these filters—in particular, the error filters—in your Applesoft programs? The concept is fairly straightforward, although most Applesoft programs let some dirt and trash get through. First, let's take a look at some of the filters that exist on the Apple, and then see how we can improve them.

The Existing Filters

DOS 3.3 or ProDOS, working with the Applesoft interpreter, trap out errors for the programmer. The existing filters stop execution when an error is detected. In other words, errors recognized by the computer do not get through. The error messages are provided on page 136 of the *Applesoft Reference Manual* and pages 114-115 of the *DOS Reference Manual,* or page 212 of *Basic Programming With ProDOS.* Pages 59-62 in the March 1983 issue of *Call -A.P.P.L.E.* also provides an excellent error message dictionary.

Program execution is terminated to prevent erroneous results from being generated. While keeping the trash off of your disk and out of your reports, the error filter is somewhat abrupt. It generally requires manual intervention to correct the error before proceeding. While this is usually considered acceptable when developing and debugging a program, a more suitable technique is necessary if the executing program is to handle the errors with minimal or no intervention from the user.

The ONERR Filter

Applesoft provides the ONERR statement to allow a program to handle errors that occur during execution. ONERR is described on page 141 of the *Applesoft Programmers Reference Manual.* ONERR GOTO is used to avoid having a message generated and execution terminated. ONERR has a somewhat undesirable side effect as a filter: it traps *all* errors. In other words, every error is passed to the error handling routine in the executing Applesoft program. The BASIC program statements must then determine if the error is one that can be accepted. If not, then the program must provide some indication of the error, and then possibly terminate execution.

The ONERR command sets a single flag (bit 7 of location 216) to indicate that errors will be handled by the executing program. When an error occurs, the error handler in Applesoft tests this bit to determine if a message is to be issued, or if the program will handle the error. This same test is also performed for DOS 3.3 or ProDOS errors. In either case, control is passed to the executing program via the Applesoft error handling routine. At this point, the executing program must determine what to do with the error.

Error Handling In Applesoft Programs

An error handling routine in an Ap-

plesoft program can be very simple or very complex. One of the easiest is "END OF DATA" when reading text files (error code = 5). A single test of location 222 can be used to determine if the expected error occurred. More complex error handling is performed by programs that try to be user friendly. In this situation, program logic must handle the expected errors, and provide alternative action for those errors which will not be handled.

Whether simple or complex, most error handling routines will take some or all of the following actions:

1. Set location 216 to zero to turn off the ONERR flag. This is to avoid reentering the error handling routine if a subsequent error occurs while processing the initial error condition. A new ONERR command can be issued for this situation.
2. Extract the error number from location 222 to determine if it matches the expectations of the error handling routine.
3. Execute the stack fix routine if necessary to insure that program execution continues properly under certain conditions. This is usually required if the error occurs within loops, subroutine calls, PRINT, or out of memory conditions.
4. Provide messages for some types of errors.
5. Continue execution depending on the error.
6. Terminate execution depending on the error.

For some error conditions, program execution will simply continue without notice (for example, end of data on a disk file). For other conditions, program execution may continue after issuing an appropriate message. At this point, many programs issue the same or similar messages that would have been issued anyway (ILLEGAL QUANTITY ERROR is a good example).

What if the error is one that cannot be handled and your program must terminate? The fastest way out is to issue a message indicating the line number and error number. Then, you must look up the error message to determine what happened.

Obviously, this can take a lot of code in your program to provide a complete error handling routine. Instead of an error filter coded in BASIC, let's look at very simple ampersand routine.

The Clean Error Act Of 1985

&ONERR is an assembly language routine which you can use in Applesoft error handling. This routine provides several functions which are usually coded in error handling routines:

1. Clear location 216.
2. Extract location 222 and filter out the

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All times in seconds. (Time Test programs available)		DAVID DOS-II	ProDOS	DOS 3.3
TEXTFILES (100 Sectors)	TSAVE	8.0	NO	NO
	TLOAD	6.2	NO	NO
(791 Strings,	WRITE	29.3	28.0	88.4
32 chars ea)	READ	24.3	16.3	83.8
	PRINT/READ	44.2	45.9	117.1
(442 Sectors, 7 x 500)	APPEND	142.3	142.9	1231.2
APPLESOFT (100 Sectors)	*SAVE	6.4	16.4	33.1
	LOAD	5.0	4.0	23.5
INTEGER (100 Sectors)	*SAVE	6.6	NO	33.4
	LOAD	4.9	NO	23.4
BINARY (100 Sectors)	*BSAVE	7.3	18.4	28.7
	BLOAD	5.8	4.8	24.5
48K PROGRAM SPACE	APPLESOFT	36,352	NO	36,352
(With 3 Bufs avail)	INTEGER	36,352	NO	36,352
	BINARY	36,352	34,816	36,352
64K PROGRAM SPACE	APPLESOFT	46,592	32,256	35,756
(With 4 Bufs avail)	INTEGER	46,592	NO	35,756
	BINARY	46,592	41,728	35,756

*Add 5 seconds for Verify. Apple II, Applesoft & ProDOS are trademarks of Apple

Ten New DOS Commands

1. HIDOS moves DOS above 48K memory.
2. FRE makes ultra-fast garbage collection.
3. DATE stamp files. Clock or manual dating.
4. TLOAD speed loads all Text Files to mem.
5. TSAVE speed saves Text Files from memory.
6. TLIST lists all Text Files to screen/printer.
7. DUMP Binary/Ascii to screen or printer.
8. DISA disassembles Binary to screen/printer.
9. AL prints program Address & Length.
10. / is a one keystroke Catalog.

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errors which will not be handled by the executing program.

3. If the error is not handled by the ONERR routine, then pass control to DOS 3.3, ProDOS, or Applesoft to issue the error message and terminate execution.
4. If the error is handled by the executing program, optionally list the error message before returning.
5. Optionally execute the stack fix routine.

A lot of the clutter in your BASIC error handling routine can now be taken care of by a simple call to &ONERR. The call syntax is:

& ONERR [LIST] [POP]
[error#] [,error#, . . .]

All operands are optional. If there are no operands, then all errors are passed along to the executing program. Location 216 is cleared before returning.

When the LIST option is coded, the appropriate error message is displayed. The bell is not sounded and the message is not preceded or followed by any carriage returns for DOS 3.3 or Applesoft. ProDOS has a return and bell character before each message and a return after the message (these are embedded in the encoded messages in BASIC.SYSTEM). LIST must precede any other operands.

If POP is coded, the stack fix routine is called before returning to the error handling routine. POP must precede the list of error numbers (and follow LIST if LIST is also coded).

&ONERR will extract location 222 and compare it to the values in the list of numbers. If location 222 matches any of the values in the list, then control is returned to the program error handling routine. If location 222 does not match any of the numbers, the program terminates by passing control to the Applesoft, DOS 3.3, or ProDOS. The list of error numbers may be numeric constants, variables, or expressions. Some examples:

- &ONERR 5,133: REM accept end of data and division by zero
- &ONERR LIST X: REM accept error numbers that match the value of X; print the error message as well
- &ONERR POP 53,69: REM accept illegal quantity and overflow errors plus call the stack fix routine
- &ONERR LIST : REM accepts all errors and issues a message

A typical error handling routine will first invoke &ONERR with POP and a list of error numbers. &ONERR LIST may be used later to display the message if a message is necessary. If the error handling routine has accepted an error and later program logic determines that the error cannot be processed, then use &ONERR 23 to terminate execution (Applesoft will issue the error message and line number where the error occurred). The number 23 is a non-existent error number (it will not match the value at location 222 and control will go to Applesoft).

The sample program, ONERR DEMO, includes the ampersand routine in the program statements. The &ONERR routine is loaded into page 3 ($0300). The second sample program, ONERR MESSAGE TABLE, lists all of the Applesoft and DOS 3.3 or ProDOS messages. Once &ONERR is loaded into page 3, it can be saved as a binary file with BSAVE ONERR,A$300,L$B9 (or A768,L185). You can then use BRUN ONERR to load &ONERR for other programs.

Two error codes will not occur during the execution of an Applesoft program. These are #149 (ILLEGAL DIRECT) and #210 (CAN'T CONTINUE). DOS 3.3 error #15 (NOT DIRECT COMMAND) can occur when a program is executing. This happens if a program is restarted with CONT or GOTO, and a DOS 3.3 command is issued immediately after the restart. Location 51 (Applesoft prompt character) is not cleared by CONT or GOTO. In this situation, DOS 3.3 commands are rejected since DOS thinks the command is being issued from the keyboard. If ONERR is active (location 216 = $80), then DOS 3.3 does not issues the error message. Since DOS 3.3 thinks the command is from the keyboard, control is not passed to the error handling routine.

Error codes 254 (bad response to an input statement) and 255 (control C interrupt attempted) do not have corresponding messages in the error message table. If ONERR is active, these codes are passed to the error handling routine. If ONERR is not active, then ??REENTER is generated by INPUT and "break in line #" is generated by control C.

The Assembly Language Routine For &ONERR

The listing of &ONERR is fully commented to indicate what occurs when the routine is invoked. The first 11 bytes of generated code set up the ampersand vector. The remaining code is fully relocatable, so the program can be placed anywhere in memory (if page 3 is already in use). If the program is relocated in memory, the ampersand vector setup must be adjusted to use the new address.

Three Applesoft tokens are chosen as the command byte and first two optional operands. Use of &ONERR in your Applesoft program is fairly easy to understand when viewed on a program listing. The values in the list of error numbers must be in the range 0-255 (illegal quantity otherwise). Location 216 is cleared before the list is scanned. A quantity error in the list will generate the quantity error message even though error code 53 is one of the values in the list. The same applies to other errors that can be detected while scanning the list of acceptable error numbers (syntax, type mismatch, etc.) Caution: if the ampersand routine is entered and the first token is not ONERR, then an attempt will be made to generate a syntax error. This will produce a loop between Applesoft and the &ONERR routine, since location 216 is not cleared until after it has determined that the first token is ONERR.

Error handling in Applesoft uses several page zero locations:

Address	Name	Description
216 ($D8)	ERRFLG	$80 = ONERR active
218-219 ($DA/DB)	ERRLIN	line # where the error occurred
220-221 ($DC/DD)	ERRPOS	saved value of TXTPTR ($B8/B9), used by RESUME
222 ($DE)	ERRNUM	error number
223 ($DF)	ERRSTK	saved stack pointer (used by the stack fix routine)
244-245 ($F4/F5)	ONTXTP	saved value of TXTPTR for GOTO command following ONERR
246-247 ($F6/F7)	ONCURL	saved value of CURLIN where the ONERR GOTO command was issued

These last two fields are not well documented. Their usage was determined by using the monitor to examine the ONERR code at location $F2CB in Applesoft. Many of these locations can be examined by your error handling routine to determine what action to take.

Now You Can Clean Up Your Act

With &ONERR, you should be able to enhance your error handling routine for more complete control over error situations. This is especially important if your applications are to be user friendly. &ONERR can relieve the burden of having to generate messages from your program (and save space). Install a new error filter, &ONERR, for longer program life and reliable operation.

&ONERR was developed on a 48K Apple II+ with Applesoft in ROM, and DOS 3.3 (smaller systems will have to adjust the DOS addresses used). It was further updated to ProDOS on an Apple *//e*. The Merlin Pro assembler was used. &ONERR was developed to improve error handling in a menu driven application which made heavy use of files. ONERR GOTO is used throughout the application with several different error handling routines using &ONERR. I use a different ONERR GOTO for keyboard input, and each different file that is processed. &ONERR made it easier to program the application.

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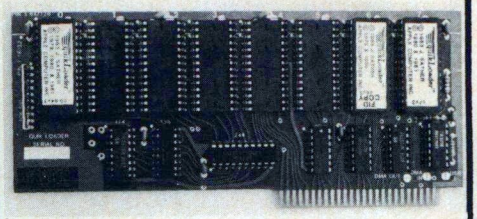

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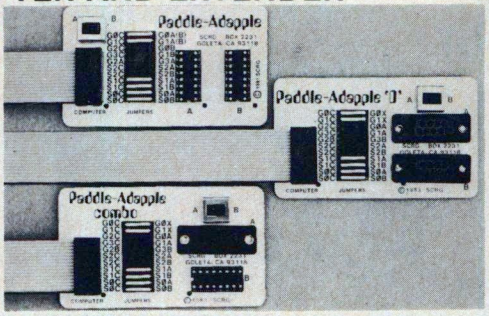

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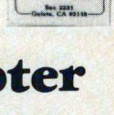

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Circle 75 on Reader Service Card

ONERR MESSAGE TABLE

```
100  REM &ONERR DEMO PROGRAM
110  REM (C) 1983 KEN KASHMAREK
120  GOSUB 300: CALL 768
130  ONERR  GOTO 160
140  REM NOW, COMMIT SOME ERROR
150 X = 1 / 0: REM ZERO DIVIDE
160  &  ONERR  LIST  POP 133
170  PRINT : PRINT "ZERO DIVIDE M
     ESSAGE WILL APPEAR": PRINT
180  ONERR  GOTO 200
190 X =  /  /  /  /
200  &  ONERR  POP 16
210  HTAB 8: &  ONERR  LIST : PRINT

220  PRINT "SYNTAX ERROR MESSAGE
     WILL APPEAR": PRINT
230  ONERR  GOTO 250
240  POKE 0,44876
250  &  ONERR 53: PRINT "THIS TIM
     E, NO MESSAGE APPEARED (ILLE
     GAL QUANTITY)"
260  ONERR  GOTO 290
270  PRINT : PRINT "THIS TIME, TH
     E PROGRAM WILL STOP WITH A 'B
     ASIC ERROR IN 280"
280  NEXT : REM NEXT WITHOUT FOR
290  &  ONERR 6,16,133: REM DID N
     OT TRAP 0
300  PRINT "NOW LOADING &ONERR RO
     UTINE": PRINT : GOTO 320
310 H$ = H$ + "ND9C6G": FOR I = 1
      TO  LEN (H$): POKE 511 + I,
      ASC ( MID$ (H$,I,1)) + 128:
      NEXT : POKE 72,0: CALL  - 1
     44: RETURN
320 H$ = "0300:A9 0B 8D F6 03 A9
     03 8D F7 03 60 A9 A5 20 C0 D
     E A2 00 86 D8 85 06 C9 BC D0
      03 20 B1 00 C9 A1 D0 0C 20
     B1 00 68 A8 68 A6 DF 9A 48 9
      8 48 20 B7 00 F0 46 20 F8 E6
       E4 DE F0 3C 20 B7 00 F0 05
      20 BE ": GOSUB 310
330 H$ = "0340:DE D0 EF A5 DA 85
     75 A5 DB 85 76 A4 DE F0 21 A
     D D1 03 D0 11 AD D2 03 C9 BE
      D0 0A C0 16 B0 11 98 20 0C
     BE 18 60 C0 10 B0 07 20 E0 9
     E 98 4C D2 A6 98 AA 4C 12 D4
      20 95 D9 A5 06 C9 BC D0 3A
      A6 DE ": GOSUB 310
340 H$ = "0380:F0 1D AD D1 03 D0
     11 AD D2 03 C9 BE D0 0A E0 1
     6 B0 0D 8A 20 0C BE 18 60 E0
      10 B0 03 4C 02 A7 BD 60 D2
     48 20 5C DB E8 68 10 F5 A2 0
     0 A0 06 BD 50 D3 20 5C DB E8
      88 D0 F6 60 ": GOSUB 310
350  PRINT "&ONERR ROUTINE NOW LO
     ADED": PRINT : RETURN
```

ONERR DEMO

```
10  REM ONERR MESSAGE TABLE
20  REM (C)1983 BY KEN KASHMAREK
30 A = 1:N = 16
35  IF  PEEK (977) = 0 AND  PEEK
     (978) = 190 THEN A = 2:N = 2
     1
40  FOR I = A TO N
42  POKE 222,I
44  PRINT I;: &  ONERR  LIST
46  IF N = 16 THEN  PRINT
50  NEXT I
60  DATA 0,22,42,53,69,77,90,107,
     120,133,149,163,176,191,210,
     224
70  FOR I = 1 TO 16
75  READ J: PRINT J; TAB( 6);
80  POKE 222,J
85  &  ONERR  LIST
90  PRINT
100  NEXT I
```

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Circle 80 on Reader Service Card

& ONERR

```
*                       Applesoft ONERR Assist Routine
*       Copyright (C)   1985 By Ken Kashmarek
        SKP  1
*       Assembled by    Merlin Pro
        SKP  1
*       Function: Mask  out errors which should
*                        be trapped. Pass others along to
*                        Basic or DOS. In addition, print
*                        error message if "LIST" coded.
        SKP  1
*       Usage: &ONERR   [LIST] [POP] [errors]
*       Where: Without  any options, all errors
*                       are taken, and the stack fix routine
*                       is not used. If the error matches a
*                       value in the list (Applesoft manual
*                       page 136, DOS manual page 114-115)
*                       Then control is returned following
*                       the &ONERR. If "LIST" is coded, the
*                       message is printed (no carriage return
*                       or bell). If ERRNUM does not match,
*                       then control goes to DOS or Applesoft.
*                       If "POP" is coded, then the stack fix
*                       routine is invoked.  If "LIST" is
*                       coded, "POP" must follow "LIST".
*
*       EXAMPLE:10 ONERR GOTO 50
*                               50 & ONERR LIST 1,16
*
*            Rejects    all but "LANGUAGE NOT
*            AVAILABLE" and "SYNTAX ERROR"
*            Execution  continues in the ONERR
*            routine    if ERRNUM is one of these
*            two        errors.
        SKP  1
*       SYMBOL TABLE    DEFINITIONS
        SKP  1
LSTFLG  EQU  $06        ;LIST MSG FLAG
CHRGET  EQU  $00B1      ;GET NEXT CHAR
CHRGOT  EQU  $00B7      ;GET CURRENT
CURLIN  EQU  $75        ;CURRENT LINE
ERRFLG  EQU  $D8        ;$80=ONERR ON
ERRLIN  EQU  $DA        ;LINE NUMBER
ERRPOS  EQU  $DC        ;SAVE TXTPTR
ERRNUM  EQU  $DE        ;ERROR NUMBER
ERRSTK  EQU  $DF        ;SAVE STACK
AMPV    EQU  $03F5      ;AMPERSAND VEC
UNHOOK  EQU  $9EE0      ;DOS UNHOOK
DOSERR  EQU  $A6D2      ;DOS ERR CODE
DOSMSG  EQU  $A702      ;PRINT DOS MSG
ERMSTB  EQU  $D260      ;ERR MSG TABLE
ERR     EQU  $D350      ;" ERROR"
ERROR   EQU  $D412      ;BASIC ERROR
DATA    EQU  $D995      ;SKP TO :
OUTDO   EQU  $DB5C      ;PRINT CHAR
CHKCOM  EQU  $DEBE      ;CHECK FOR ,
SYNCHR  EQU  $DEC0      ;CHECK A
GETBYT  EQU  $E6F8      ;TXTPTR->X
PRODOS0 EQU  $03D0      ;JMP PRODOS1
PRODOS1 EQU  $BE00      ;BASIC.SYSTEM START
PRODOS2 EQU  $BE0C      ;ERROR MESSAGE
*       SET  UP         AMPERSAND VECTOR
        SKP  1
        ORG  $0300
        LDA  #<ONERR    ;SET UP AMPV
        STA  AMPV+1
        LDA  #>ONERR
        STA  AMPV+2
        RTS
        SKP  1
*       &ONERR ENTRY    FROM AMPERSAND VECTOR
        SKP  1
ONERR   LDA  #$A5       ;ONERR TOKEN?
        JSR  SYNCHR     ;CHECK IT OUT
        LDX  #0
        STX  ERRFLG     ;CLEAR
        STA  LSTFLG     ;KEEP A
        CMP  #$BC       ;LIST MESSAGE?
        BNE  ONER00     ;NO
        JSR  CHRGET     ;SKIP TOKEN
ONER00  CMP  #$A1       ;POP STACK FIX
        BNE  ONER01     ;NO
        JSR  CHRGET     ;SKIP TOKEN
        SKP  1
*       STACK FIX       ROUTINE FROM PAGE 136
*       OF   APPLESOFT  REFERENCE MANUAL.
        SKP  1
        PLA             ;PULL RETURN
        TAY             ;  ADDRESS OFF
        PLA             ;  STACK
        LDX  ERRSTK     ;RESTORE STACK
        TXS             ;  POINTER
        PHA             ;PUSH RETURN
        TYA             ;  ADDRESS TO
        PHA             ;  STACK
ONER01  JSR  CHRGOT     ;GET TXTPTR
        BEQ  ONER4      ;BR AT END
ONER0   JSR  GETBYT     ;ERROR SELECTION
        CPX  ERRNUM     ;DO WE WANT IT
        BEQ  ONER3      ;BR IF MATCH
        JSR  CHRGOT     ;CHAR AT TXTPTR
        BEQ  ONER1      ;BR IF AT END
        JSR  CHKCOM     ;COMMA?
        BNE  ONER0      ;BR IF ,
        SKP  1
*       AT   THIS       POINT, ERRNUM DOES NOT MATCH
*       ANY  CODE       IN THE &ONERR SELECTION.
        SKP  1
ONER1   LDA  ERRLIN     ;RESET THE
        STA  CURLIN     ;  LINE # IN
        LDA  ERRLIN+1   ;  ERROR FOR
        STA  CURLIN+1   ;  MESSAGE
        LDY  ERRNUM     ;GET CODE
        BEQ  ONER2      ;ZERO=BASIC
        LDA  PRODOS0+1  ;IS IT PRODOS?
        BNE  ONER15     ;MUST BE DOS.
        LDA  PRODOS0+2
        CMP  #>PRODOS1
        BNE  ONER15     ;NOT PRODOS
        CPY  #22        ;WHOSE ERRNUM?
        BCS  ONER2      ;TO BASIC
        TYA             ;CODE TO A
        JSR  PRODOS2    ;PRINT ERROR MSG
        CLC
        RTS
ONER15  CPY  #16        ;IS IT DOS?
        BCS  ONER2      ;BR IF BASIC
        JSR  UNHOOK     ;UNHOOK DOS
        TYA             ;CODE TO A
        JMP  DOSERR     ;DOS HANDLER
ONER2   TYA             ;FOR BASIC
        TAX             ;  CODE TO X
        JMP  ERROR      ;TO BASIC
        SKP  1
*       AT   THIS       POINT, ERROR IS TO BE HANDLED
*       BY   THE        BASIC PROGRAM.
        SKP  1
ONER3   JSR  DATA       ;SKIP TO :
ONER4   LDA  LSTFLG     ;LIST MESSAGE
        CMP  #$BC       ;LIST?
        BNE  ONER9      ;IF NOT, EXIT
        LDX  ERRNUM     ;GET CODE
        BEQ  ONER5      ;ZERO=BASIC
        LDA  PRODOS0+1  ;IS IT PRODOS?
        BNE  ONER45     ;MUST BE DOS.
        LDA  PRODOS0+2
        CMP  #>PRODOS1
        BNE  ONER45     ;NOT PRODOS
        CPX  #22        ;WHOSE ERRNUM?
        BCS  ONER5      ;TO BASIC
        TXA             ;CODE TO A
        JSR  PRODOS2    ;PRINT ERROR MSG
        CLC
        RTS
ONER45  CPX  #16        ;IS IT DOS?
        BCS  ONER5      ;BR IF BASIC
        JMP  DOSMSG     ;PRINT DOS MSG
ONER5   LDA  ERMSTB,X   ;GET MSG CHAR
        PHA
        JSR  OUTDO      ;PRINT CHAR
        INX
        PLA
        BPL  ONER5      ;UNTIL DONE
        LDX  #0
        LDY  #6
ONER6   LDA  ERR,X      ;" ERROR"
        JSR  OUTDO
        INX
        DEY
        BNE  ONER6
ONER9   RTS
        LST  OFF
```


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Circle 87 on Reader Service Card

Speeding Along with the MACH 3.5

Part 2: Theory and Optimization

Dr. David A. Lingwood

Why Worry?

Mostly, you just plug in the Mach 3.5 cache memory speed-up card and *go*, as noted in the previous article. Most applications software will work just fine. True. This article, however, assumes that you just can't leave well enough alone. It gives more details on the design of Mach 3.5, and works from these to present several strategies for wringing even more speed out of your programs. We also have more timing comparisons of interest to programmers.

This article is designed for the programmer, obviously. The major premise is that you want your sped-up Apple to crank just as fast as possible. If you don't enjoy picking computational nits, you can let well enough alone.

Mach 3.5 Theory and Design

(Much of this is taken from Steve Wright's presentation at the July, 1985 A.P.P.L.E. Co-op meeting. My thanks.) In general, the larger a memory or storage area is, the slower it must be. Cost of components and power use account for this. Disk and other storage is relatively slow. Memory comes next in speed. Finally, the processor chip itself handles information with the greatest speed. The notion of a cache memory is to place a small, but very fast, memory in between the processor and other memory. Control circuitry is needed to control access to this memory; on mainframe computers cache control may be very sophisticated, trying to anticipate which information is likely to be used next. Microcomputers demand simpler solutions.

Mach 3.5 uses a very simple 4K cache, and a 65C02 processor chip, running at 3.58MHz. It uses simplified control circuits to indicate whether the needed information is in the cache or not, or if the

card must slow down to access the regular Apple memory or its disk drives. The Mach 3.5 contains four 2016-90 static RAM chips, each one 2048x8 bits. Half of this (4096 bytes) is the cache, and the other half is "tag memory" used to control cacheing (see below). All writes (stores) are made to both the cache and Apple memories. All reads (load instructions) are made from the cache if possible, otherwise from Apple memory.

An alternative approach to speeding up an Apple is to design a card that completely replaces the normal RAM with faster chips. The problem with this method is that such cards must either be revised or initially "set-up" to work with different memory configurations and computer models. The trade off is, however, that cache memory cards will vary in effective speed, depending on how much "cache swapping" is necessary. The size of the cache affects this. Tests by the Mach 3.5 designers showed that a cache larger than 4K did not improve performance enough to justify the extra cost and power consumption required.

Mach 3.5 uses ICs (Programmable Array Logic chips, or "PALs") that tell it which parts of the Apple memory are to be swapped in and out of the fast cache memory. The regular 48K of the Apple, together with the language card space are cached. The following Apple memory is *not* cached:

- peripheral card ROM space ($C000-$CFFF)
- auxiliary memory on a *//e*; so the card has no speed-up effect on software or data stored in auxiliary,
- multiple-banked *//e* RAM cards.
- RAM banks on II-compatible 128K RAM cards; in fact, if such RAM is used by software, Mach 3.5 can't track the bank switching, and will make serious errors (this is a problem with some fast disk copying software).

In addition to the perhiperal ROM slow-down, the card adds a 50 millisecond delay before each access to locations $C0E0-EF. These are the actual I/O locations for the slot 6 disk controller. A jumper provides similar delays for locations $C0C0-DF, or the I/O locations for controllers in slots 4 and 5.

It is possible to order custom PAL chips for Mach 3.5, if you need to have it work with II + -compatible RAM cards, slow down slot 7, or access paddles at a fast rate.

The final trade off, to get the lower cost and flexibility of a cacheing card, is that various programs will vary in their performance, and the programmer may, to some extent, optimize programs for use with the card. That is what the rest of this part of the article is about.

Controls

Here are the ways you may control the Mach 3.5:

Jumper on card

On = slow down slots four and five to normal speed. (Slot six always at normal speed.)

Within two seconds of power-on

ESCape: completely disconnect card until next power-on.
1: test memory with Mach 3.5 active.
T: test memory with Mach 3.5 inactive.

Programmer controls

Shut off Mach 3.5 until next power-on: POKE 49243,0 ($C05B:0).
Must be followed by a ctrl-RESET.

Slow down to normal Apple speed for 50 milliseconds: X = PEEK(-16152) (BIT $C0E8). Note: this accesses the "disk off" location in standard Apple controller in slot 6; check for compatibility with other controllers. Add this to wait loop or paddle read routines.

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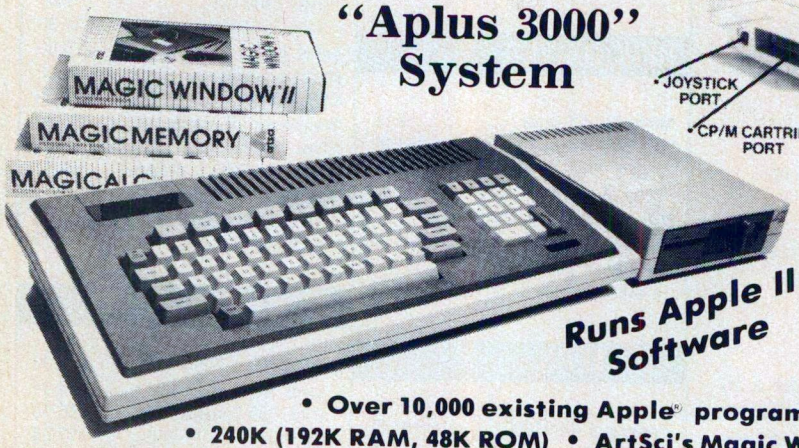

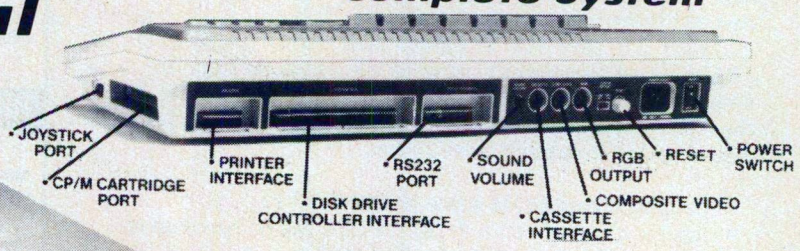

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- provide a disk controller slow-down for slot 7, or
- permit operation with bank-switching II RAM cards, by slowing down to normal for all language card-type areas.

The first two PAL sets lack the slot four/five slow-down feature.

The Tag Memory

Obviously, the card needs some way of remembering what is in the cache and what isn't, and which locations are "cacheable." It does this with the "tag memory" area, parallel to the cache memory. Think of the Apple memory as divided into 16 4K blocks:

Memory (Hex)	Tag
0000 - FFF	0
1000 - 1FFF	1
2000 - 2FFF	2
3000 - 3FFF	3
4000 - 4FFF	4
5000 - 5FFF	5
6000 - 6FFF	6
7000 - 7FFF	7
8000 - 8FFF	8
9000 - 9FFF	9
A000 - AFFF	A
B000 - BFFF	B
C000 - CFFF	C
D000 - DFFF	D
E000 - EFFF	E
F000 - FFFF	F

The cache memory can hold only one block-worth of information, but any given byte may have come from any of the 16 blocks above. The tag tells which block they came from.

The tag is the modulo $1000 of the address. In other words, the tag is the high nibble (four bits) of the high byte: 0 through F. Three of the other four bits in each tag byte are used by the "match enable" circuit of the card: these emulate the soft switches of the Apple, and indicate the source of the information in the cache: language card or not, text page or not, auxiliary or main memory. The remaining bit signals whether a match, once made, is to be used. This "no good" bit is how the card masks out the auxiliary memory, peripheral card ROM, etc.

The hardware checks to see if the tag of each byte matches what is already in the cache. If so, it uses the value in the cache—at high speed. If not, or if the location is "no good" (e.g., in peripheral space, etc.), the card reads the memory location into the cache. When the card is instructed to write to memory, it writes to both the cache and the Apple memory, but may do so without slowing down, depending on what instructions come next — i.e., writes are "buffered" or "latched."

More Memorable Times

The first part of this article contained timing comparisons for popular applications software. Here we continue with timings for utilities, operating systems, and languages.

Assembler	**Mach 3.5**	**Normal**	**Speed-up**
Big-Mac C (Merlin)	169.4	220.2	1.30:1
Assemble a 1,655 line (3K) program (//e 80 columns)			

Utilities	**Mach 3.5**	**Normal**	**Speed-up**
DOS 3.3:			
Boot & load Integer	18.3	19.4	1.06
INIT HELLO	29.1	29.7	1.02
(1-line HELLO)			
COPY A	82.1	88.5	1.08
2-drive disk init & copy			
ProDOS:			
Boot Users Disk	11.6	12.1	1.05
Format disk	22.3	23.2	1.04
Format & copy Users Disk to 2nd drive	69.7	75.3	1.08
Convert 29K text file to PRODOS	40.2	42.1	1.05
A.P.E.			
Search to end of 15K program	11.1	31.4	2.83

Applesoft (DOS 3.3, unless noted)		**Mach 3.5**	**Normal**	**Speed-up**
Load 15,270 byte program		15.5	16.2	1.04
Save the program		21.4	22.1	1.03
List the program to //e 80-column screen		46.4	58.5	1.26
List to 40 column screen		23.4	42.5	1.82
Garbage collection		9.3	31.3	3.34
Simple programs:				
FOR I = 1 TO 2000:	DOS:	8.7	21.3	2.45
NEXT	ProDOS:	9.4	23.0	2.45
FOR I = 1 TO 1000:	DOS:	15.6	17.0	1.09
HOME: Next	ProDOS:	15.7	17.1	1.09
HGR:FOR I = 1 TO	DOS:	11.6	36.9	3.18
1000:HPLOT	ProDOS:	11.7	37.1	3.17
1,1 TO 150,150:				
NEXT				
Write #s 1-1,000	DOS:	13.7	23.5	1.71
to text file	ProDOS:	12.0	19.1	1.59
Read 1,000 #s	DOS:	11.3	21.1	1.87
from file	ProDOS:	8.1	10.5	1.29
Write 1,500 record DOS random access file		39.0	94.0	2.41
Applesoft "Sieve of Eratosthenes"*				
Published pgm.		130.9	244.0	1.86
1 iteration				
(Note: IBM PC BASIC			180.0	
10 iterations		1,085.0		
Reprogrammed for speed,		49.0	134.7	2.75
1 iteration				
10 iterations		564.00		

Integer BASIC	**Mach 3.5**	**Normal**	**Speed-up**
Sieve benchmark			
Published pgm.	73.2	227.0	3.10
1 iteration			

Pascal		**Mach 3.5**	**Normal**	**Speed-up**
Pascal 1.2, //e**				
Sieve benchmark				
Run				
10 iterations,	128K	195.0	480.0	2.46
1,899 primes	64K	125.0	420.0	3.36
Compile 10K lines	64K	870.0	1,615.0	1.86
+ SSD RAM card	64K	420.0	910.0	2.17
RAM swapping on	128K	1,300.0	1,695.0	1.30
+ SSD	128K	560.0	1,085.0	1.94
Swapping off	128K	625.0	1,110.0	1.78
+ SSD	128K	480.0	930.0	1.94

Machine Language	**Mach 3.5**	**Normal**	**Speed-up**
Monitor:			
800:0 N801 800.7FFEM	.7	1.8	2.57
D393LLLLLLLLLLLLLL	6.5	5.1	1.27
Test program:			
2,162,687 JSRs (see below)	16.7	49.6	2.97

* Krajewski, 1984; error in program corrected based on Eldred, 1984. Time for one iteration; 1,651 prime numbers.

** Times provided by Bruce van Norman. See Gilbreath & Gilbreath, 1983.

Note that in compute-intensive functions, the card comes close to its maximum 3½ times speed-up. When dealing with the disk drive, improvements are either non-existent or very modest. The actual act of reading or writing happens at normal Apple speed, but processing related to read/write gets benefit of the speed-up.

Longer programs, such as the applications software tested in the first part of this article, provide better tests of the card than do brief programs. Short programs are more subject to anomalies caused by

memory cacheing, for example, note the different speed-ups in the short Applesoft tests. These should average out in a long program.

The Applesoft "sieve" benchmark is interesting. Note that the "efficient" version of the program shows a greater speed gain than did the original. The efficient program is shorter, uses more loops (as opposed to "GOTOs"), and probably uses fewer of Applesoft's internal routines. All of this translates into greater efficiency of the Mach 3.5 card. In general, smaller, more self contained, and more "loop-oriented" programs will gain more benefit from the card than will other programs.

Also of interest is the fact that the sped-up Apple runs the original benchmark faster than an IBM PC (131 vs. 180 seconds, a 1.37 speed-up)! Efficient programming in Applesoft coupled with the Mach 3.5 runs the program 3.6 times faster than the IBM. There are speed-up cards for IBM, also, and the original program could, no doubt, be made much more efficient on the IBM as well. Of course, Pascal run time (64K) is 4.5 times faster than the best Applesoft version for 10 iterations.

The compute-intensive ProDOS Applesoft tests take slightly more time than do their DOS counterparts. This is due to the fact that ProDOS hooks in to all running Applesoft programs (through trace). File I/O is faster under ProDOS, however, and the degree of speed-up for Mach 3.5 is similar under both operating systems.

The Pascal sieve benchmarks by Bruce van Norman show that Mach 3.5 does have a benefit with Pascal 1.2 in 128K, though there is greater speed-up running the program in the 64K Pascal. Pascal 1.2 stores the P code in auxiliary memory, hence this is less efficient. There is a useful interaction with the SSD RAM card as a pseudo-disk for large compiles. Fastest compiles were gotten using Mach 3.5 and the SSD, with 64K Pascal.

PROGRAMMING FOR SPEED

Programmers who are interested in speed may optimize programs for use with the Mach 3.5. There are tricks that run the gamut from the coding of assembly language to overall program design and storage access strategies. Let's begin small.

Assembly Language Programming

In general, shorter and more repetitive assembly programs will run faster. Loops are better than "pipelined" code with the Mach 3.5. The shorter the program, the more likely it is that all of it will fit within the cache memory.

Memory locations used by the program, data, zero-page and the stack also can have dramatic effects on program performance. The use of overlapping memory locations, requiring cache swapping, reduces speed. Consider the following example machine language program:

```
0000: FF FF 20   (a three-byte counter)
1020: 20 50 20   JSR   $2050   DUMMY
      C6 00      DEC   $00     DECREMENT
      D0 F9      BNE   $1020   THE THREE-
      C6 01      DEC   $01     BYTE COUNTER
      D0 F5      BNE   $1020   DOWN TO ZERO
      C6 02      DEC   $02     REPEATING THE
      D0 F1      BNE   $1020   DUMMY SUBROUTINE
      4C DD FB   JMP   $FBDD   BELL
2050: EA         NOP            DUMMY
      EA         NOP            SUBROUTINE
      60         RTS
```

This routine requires 49.6 seconds without Mach 3.5, and 16.7 with it (a 2.97 speed-up). Note that I've made sure that the low bytes don't overlap in the program, the three-byte counter, or the dummy subroutine.

After the first time through the loop tag and cache look like this:

Location (low byte)	Tag	Cache
00	0	FE (decremented by one)
01	0	FF
02	0	20
.		
.		
20	1	20
21	1	50
22	1	20
23	1	C6
.		
.		
50	2	EA
51	2	EA
52	2	60

If you move the dummy subroutine to $2020, and change

```
1020:  20 20 20   JSR   $2020   RELOCATED DUMMY
```

the run time with Mach 3.5 increases to 20.3 (only a 1.23 speed-up). Why? In the revised version, the JSR at $1020 overlaps the three bytes of the the dummy subroutine. Mach 3.5 must swap these locations, at normal Apple speed, each time through the loop. The card's hardware takes care of re-setting the tags.

Note that if I had written this program so that it began at $1000, there would now be three overlapping areas: the program, the dummy subroutine, *and* the zero-page counter. Speed would be further degraded.

The speed-up doesn't reach the maximum of 3.5 in part because the counter bytes are stored in normal zero page RAM, at normal speed; in many cases this can be avoided by using the 6502's registers for the counters. It doesn't help in this example; however, in a comparable program, I used the X and Y registers, instead of locations $00 and $01. This ran in 43.4 seconds without the card, and 14.6 with it (2.97). When the dummy subroutine was moved to overlap with the JSR statement, the time went back up to 37.1 (1.17).

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The reason for this is masked by some "invisible" memory use in this program—the JSR itself. JSRs require two back-to-back writes to the *stack*. The stack must be treated just as any other Apple memory. More importantly, however, writes in rapid succession force the Mach 3.5 to wait. Some more design theory is useful here: the Mach 3.5 uses a latched output when writing to the Apple's memory—it sends the address and data to the latch, then goes merrily on its 3.5mHz way, executing the next instruction(s) while the write is taking place. If there are two writes (stores) to the Apple memory in a row, the card must wait until each write is finished before doing the next—in effect, slowing down to the normal Apple clock speed once more. The trick in programming is to try to separate writes by instructions that require at least four machine cycles to execute. For example:

	Slow			Fast		
2110:	LDX	#$FF	2110:	LDX	$#FF	Counter low-byte
2112:	LDA	$2105	2112:	LDA	$2105	
	LDY	$2106		STA	$03	Same test load &
	STA	$03		LDY	$2106	save code, in
	STY	$04		DEX		different
	DEX			STY	$04	order
	BNE	$2112		BNE	$2112	
	DECf	$01		DEC	$01	$20FF—0 counter
	BNE	$2112		BNE	$2112	
	DEC	$02		DEC	$02	
	BNE	$2112		BNE	$2112	
	JMP	$FBDD		JMP	$FBDD	bell

There is no lost wait time in the faster example (the LDY $2006 and INX take four cycles). With the three-byte counter of $20FFFF ($20FF in $01-02 and X = $FF), the "slow" version of the code takes 12.5 seconds, the "fast" version 11.3, a 1.10 speed-up. Note that there are other slow-downs in this program; the DEC instructions using zero-page are equivalent to writes.

Applesoft Programming

The variety in timings of the short Applesoft benchmarks should tip you off to the fact that some Applesoft routines will run faster than others. This much could be dealt with by more complete benchmarking.

There is an interaction that is almost impossible to cope with, however. That is, overlap between the Applesoft code itself, Applesoft internals used, and data. It is theoretically possible to change the speed of a small routine simply by moving it up or down in memory by adding (or removing) REM or other statements. You can't really plan for these possible overlaps. All you can do is to experiment by changing the location of critical speed-sensitive routines within your Applesoft program.

Shorter code should generally be faster. The "Sieve of Eratosthenes" benchmark shows this clearly: the longer, original benchmark gained only a 1.86 speed-up with Mach 3.5, while the shorter, more efficient program got a 2.75 speed-up.

Hard Disks

Most hard disks now on the market will let you have the choice of installation slot for the host interface card. Since hard disks do all of their own hardware-based timing, they should run perfectly well at the sped-up rate. Thus, you want to keep the interface out of slot 6 (which is always run at normal speed).

Here are some timings with a Xebec hard disk unit, equivalent to the First Class Peripherals "Sider." The test was to load a file containing both parts of this article, using the Zardax word processor. The interface card was in slot 5, and the test involved using the Mach 3.5's jumper for slot 4-5 slow-down:

	Mach 3.5		Normal
	Jumper Off	Jumper On	Apple
Load 115 sector file	3.4	7.2	7.4

In other words, compared to a normal Apple there is a 2.18 speed gain by letting the hard disk run in sped-up mode. Slot 7 seems a good choice for most hard disks: it lets your Apple auto-boot from the hard disk, and gives the speed up as well. Once you get used to 29K worth of text flashing into memory in under four seconds, you get spoiled!

General

Here are several other speed factors:

The timing data for listing an Applesoft program are instructive. With Mach 3.5 up, on a *//e*, the times for listing a 15K program were:

80 column display	46.4
80 column card up, in 40 column mode	39.0
Normal 40 column mode	23.4

Why is 80 columns so much slower? The *//e* 80 column card (and others) uses the $C300 and $C800-$CFFF space for its firmware. This ROM is always accessed at normal Apple speed; this explains the difference between normal 40 and "ESC-4" 40 columns. In addition, half of the 80 column text is stored in auxiliary memory, which is also accessed at normal speed. Put both of these together, and the *//e* 80 column display is almost exactly twice as slow as standard 40 columns!

In the area of disk access, as noted above, even though Mach 3.5 doesn't speed up disk access itself, there is a lot of data diddling done before writing to and after reading from the disk—particularly in Applesoft. The card definitely helps with this, particularly in the less-efficient DOS 3.3. There is little improvement in machine language utility access to the disk, however.

In terms of program organization, you should obviously run program code from normal, cacheable RAM. You should move program segments from auxiliary memory, and must move them from bank-switched RAM cards, before execution. Pascal 1.2 is a different issue. The card's designers don't advertise much improvement for this language, given that the P-code is stored in *//e* auxiliary memory. Nevertheless, the P-code interpreter is kept in main memory, where Mach 3.5 does generate some speed improvements.

Summary programming principles

Here, then, are the general rules of thumb for optimizing any program for the Mach 3.5:

- Use loops.
- Keep speed-sensitive loops as short as possible.
- Avoid low-byte overlap across tag boundaries.
- Avoid zero-page counter overlap with the code.
- Use the 6502 registers whenever possible.
- Avoid short JSRs when possible.
- Separate writes by a other instructions if possible (a minimum of 4 cycles).
- Work with 80 column card disconnected, or (somewhat slower) in 40-column mode of the 80 column card.
- Use cached memory for speed-sensitive code; copy code stored in auxiliary or other un-cached memory into cached RAM for execution.
- Use 64K Pascal, or run 128K version with RAM swapping off.
- Run your hard disk from slot 7, or with the slot 4-5 jumper off.

References

Eldred, Eric, "Volition Systems' Modula-2," *Byte,* June, 1984, 353.

Gilbreath, Jim & Gary Gilbreath, "Eratosthenes Revisited: Once More through the Sieve," *Byte,* Jan. 1982, 283.

Krajewski, Rich, "The Cameleon Plus," *Byte,* June 1984, 327.

THE Spreadsheet Sheet: Review of "SuperCalc3a"

Product:	SuperCalc3a
Use:	Spreadsheet with Graphics
For:	Apple (128K Enhanced //e Only), //c
Company:	Sorcim/IUS 2195 Fortune Drive San Jose, CA 95131 (408) 942-1727
Availability:	Dealers $195
Also Available:	A.P.P.L.E. Co-op $147 Product code—SCAL2

Jeffrey M. Jacques, Ph.D.

In your spreadsheet experience, have you found that:

1. You sometimes need to treat labels as if they were values.
2. You need access to spreadsheet macros—little programs which will allow you to do laborious repetitive tasks—with a single key-stroke.
3. You work on your Apple at home and have an IBM or IBM compatible at the office. Do you find yourself frustrated because you have to use widely divergent key strokes for the two different spreadsheet programs?
4. You have data saved in a standard comma delimited text file (where each value on a record is separated by a comma) that you have been using with a BASIC program? Now you would like to use your spreadsheet software to do a couple of complex calculations. Have you ever wished for an easy way to get data saved in a comma delimited file into a spreadsheet?
5. Your spreadsheet needs outstrip the functions available in AppleWorks. For example, do you need access to financial functions such as Internal Rate of Return, Future Value of an ordinary annuity, or Payments per period given the principal, interest rate and the number of payment periods?
6. You spent hours developing a worksheet, then another half hour converting it to a graph—using the DIF procedures. Have you ever found that you forgot a computation and had to start over again?
7. Or, because you had to work with a DIF file to get to or from a graphics package or data base package, have you ever mistakingly written over your worksheet file using the DIF option and then had to go back and recreate all the formulae?
8. You found that you needed only a subset of records which were scattered throughout the worksheet? Have you wished for a method of easily extracting parts of a worksheet?
9. Your spreadsheet would be improved if you could automatically use a variety of date functions?
10. You wish to create formulae which use the principles of algebraic precedence rather than first in—first out VisiCalc rules?

Well, then SuperCalc3a may be just for you. It provides all the power available on the IBM or IBM compatible machines for our Apple environment.

What You'll Need

Your hardware needs are straightforward. SuperCalc3a requires you to have an Apple *//c* or an Apple *//e*–Enhanced (with the 65C02 microprocessor) and 128K of RAM. Sorry, but those of you with older machines or those of you who have not yet upgraded your *//e* with the 65C02 will not be able to use SuperCalc3a.

Two drives are not required. Of course, you will find working with the software considerably easier with a second or even a third disk drive. Since it operates under ProDos, and since the program is too large to fit on one diskette, a hard disk would be especially helpful.

If you plan to print any of the tables and graphs, then you will need a printer or plotter. You are limited to: Apple ImageWriter, Apple Scribe, the Epson and Okidata family of printers, and the HP 2225P. Plotting graphs to paper may be done with one of seven plotters. Perhaps most limiting is that the current version (Release 1) only supports seven interface cards—most buffered interface cards are not supported. So, make sure that your hardware meets these specifications or watch for Release 2 specifications.

What You'll Get

The purchase price (i.e., $195, retail) will bring to your Apple three copyable program diskettes, a substantial (i.e., 450 pages) well developed manual, a short "10-minute guide" to using Supercalc3a, a registration card which will give you access to technical assistance (you pay for the call), and two reference cards.

Documentation

All written documentation is clear and easy to follow. The "10 Minutes to SuperCalc3a" is a good, quick introduction and tour of the spreadsheet worksheet and creating simple graphs. A more comprehensive tour, 'Learning to Use SuperCalc3," is provided in the manual. It uses 140 pages to cover the worksheet, graphics and the data base management routines. It is well done.

Additionally, the manual includes the usual introductory comments—configuring your system, working with disk files, making back-up copies, working with spreadsheets, etc. There is a well thought out appendix which makes it easy to use the program /TOOLS—more on /TOOLS later. Once you master the basics of the program, all that you will need most of the time will be the "Answer Cards." These cards summarize the commands and available functions. All in all, you have access to a nice array of well done documentation.

The /Program-Worksheet

Release 1 of SuperCalc3a is what one would expect of an integrated program built about a spreadsheet package developed by a major software house (i.e., SORCIM/IUS). It includes a typical worksheet (63 columns by 254 rows) that has more than fifty functions (i.e., mathematic functions include: rounding, averaging, logs, maximum, minimum, square root, modula, random number generation, etc.; trigonometric functions include: sin, cosine, and tangent; financial functions include: IRR, net present value, mortgage payments, present and future value of an investment; logical functions include: If, And, Or and Not; and calendar functions include: date, Julian date, etc.). Of course you will find the traditional LOOKUP function.

You will also find new and very helpful routines. For example, textual functions will enable you to take short (no more than 9 characters) labels and use them as part of a cell reference or a LOOKUP table. For example, if you wish to assign grades based on percent correct, then you might use the following LOOKUP table:

	X	Y
1	0	("F")
2	60	("D")
3	70	("C")
4	80	("B")
5	90	("A")

Using the lookup function, (e.g., LOOKUP(75,X1:X5) would return a textual value (in this case the value of C). This nicely by-passes one of the limitations of most VisiCalc and VisiCalc clone programs.

SuperCalc3a comes with a wide variety of formating commands (e.g., global and individual column width commands, display of values with commas, dollar signs, user-set decimal places, justification, etc.). You can even choose to display zeroes as a blank. You can hide and protect cells or blocks of cells easily, too.

Upon initial booting of SuperCalc3a, the screen display includes a worksheet area and an information box. Those of you who expect to find the information box at the top, a la VisiCalc, MagiCalc, etc., will be surprised that it is positioned at the bottom of the screen. The default setting for the worksheet area enables the display of 20 rows and eight columns. As one would expect, the rows are labeled with numbers while the columns are labeled with letters (A through H on the initial display screen.) Cell references, therefore, are entered in the usual manner of A1, B14, C20, etc.

The information box contains overlays which present different information at different times. Before issuing a command, the information box indicates the marker location and marker movement direction. If there is an expression stored in the cell, then the formula, values or text are noted as well as the width—number of characters—of the expression. The most extreme "last col/row" cell used in the worksheet and the amount of memory still available to the user are noted, too.

An entry of the slash command changes the information box and presents you with the usual alphabet listing of all your commands. Once you make a selection by entering a single key, the rest of the word is presented as well as several options. All options are then chosen by pressing a single additional key.

Choosing the /Replicate or /Copy commands then presents you with a third form of the information box. As the command is executed, it will give you an updated list of which rows are being calculated. Once the command is completed, the original information box is presented.

Those of you with THE Spreadsheet experience will find some differences in how formulae behave and data are entered. First, all formulae follow the general rules of algebra rather than the traditional VisiCalc rules. If A1 = 2, B1 = 3 and C1 = 4, a formula such as

A1 + B1 = C1

would produce a value of 14 in SuperCalc3a and a value of 20 in VisiCalc.

While most people with VisiCalc experience will recognize the mathematic functions—Supercalc3a uses most of the same naming conventions—the implementation of these commands are slightly different. Supercalc3a uses colons to define an ellipse rather than three periods—which is what most of us expect. When giving a command, Supercalc3a uses a comma to delimit the command references rather than the typical Visicalc conventions of a colon. So, a typical /Replicate command would look like A1:A5,B1 rather than A1. . . A5:B1.

All the commands one would expect of any sophisticated spreadsheet package are available in SuperCalc3a. Although some commands operate differently (e.g., /Replicate in VisiCalc becomes /Replicate for one-to-many cell reproduction, while /Copy is used for one to one cell reproduction), most do exactly what you would expect. Perhaps most importantly, SuperCalc3a provides several improvements over MagiCalc. These improvements include: a powerful sorting routine (i.e., /Arrange) which will work on both columns and rows, the ability to /Blank out ranges of cells or /Delete a whole range of columns or rows with a single command, and an /eXecute command which allows you to develop a canned application of many commands but only requires a single keystroke to execute. The /eXecute command is especially helpful when developing templates.

One interesting implementation in the worksheet area which is different from VisiCalc clones is that the position of the marker converts the display of row and column headers to standard output

rather than inverse video. If you still find your location in the worksheet by moving your finger to the row and column headers, then, you will find it easier to identify where your marker is located.

Data entry in SuperCalc3a is a little different from that used by THE Spreadsheet. All values are entered by pressing the RETURN key. SuperCalc3a remembers the last direction of cursor movement and then automatically moves you to the next cell—assuming that you do not disable this option. Pressing an arrow key in the entry mode does not enter a value nor move you to the next cell.

Okay, how well does the worksheet operate? Pretty well. Table 1 summarizes benchmark data and differences between Supercalc3a and THE Spreadsheet, Version 2.173. Take a few minutes and examine Table 1. Clearly, it performs spreadsheet tasks with sufficient speed and enables you to work with fairly large worksheets.

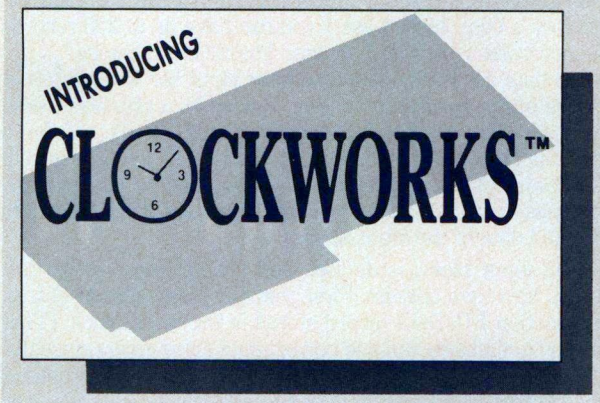
Table 1. A Summary of SuperCalc3a and THE Spreadsheet

Benchmarks	SuperCalc3a	THE Spreadsheet
Typical amount of memory upon booting with 128K Apple //e	56K	90K
Maximum # of cells		
with =1 stored in each cell	5,528 cells	9,120 cells
Re-calculation time	3.8 sec	12.4 sec
Re-calculation time using 5528 limit		7.2 sec
Using Formula 3*3*3/4		
Maximum # of cells	2,111 cells	3,513 cells
/Replicate from A1,A2:A254	1.0 sec	6.2 sec
Re-calculate (A1-A254)	5.5 sec	6.8 sec
Using Formula A1*A1 / (A1 + A1) in B1 and storing 1 in A1		
/Replicate from B1,B2:B254)	1.0 sec	6.4 sec
Re-calculate (B1:B254)	7.0 sec	7.2 sec
Time to scroll A1:A254	18.0 sec	22.9 sec
Average amount of time required to load /Insert subroutine	2.7 sec	N/A sec
Functions & Formulae Differences		
Formula length	116.0	254.0
Maximum # of nested expressions	7.0	9.0
Maximum # of arguments for Logical	2.0	many
Arithmetic Operators	Hierarchy	Left to Right
Function Differences		
Text function	YES	NO
CHOOSE function	NO	YES
Date functions	YES	NO
ASIN/ACOS/ATAN	YES	NO
COLumn function	NO	YES
FV-Future Value	YES	NO
IRR-Internal Rate of Return	YES	NO
ISDATE	YES	NO
ISNUMber	YES	NO
ISTEXT	YES	NO
MODula	YES	NO
NPV-Net Present Value	YES	NO
PMP-Payment	YES	NO
PV-Present Value	YES	NO
RANDOM function	YES	NO
ROW function	NO	YES

Note: *Analysis was based on SuperCalc3a, Release 1, and THE Spreadsheet, Version 2.173, using an Apple IIe—Enhanced. Most of the functions in SuperCalc3a and THE Spreadsheet are the same. Only the differences are noted in his table. Since not all SuperCalc3a commands are RAM resident, time tests exclude the amount of time it took to load the procedure. Real time to the user will be longer than noted here since SuperCalc3a may have to go to disk before the command can be executed.*

The /Graph

One of the major advantages of SuperCalc3a over other spreadsheet programs is that SuperCalc3a has easy access to a wide variety of graphics. You can choose from more than a half dozen different graph types (e.g., pie charts, bar/stacked bar graphs, area graphs, line charts, hi-lo charts, and X-Y scatterplots). You have con-



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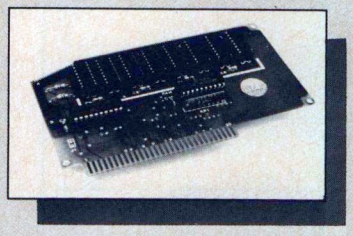

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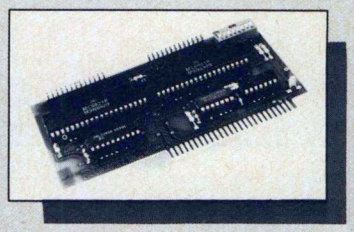

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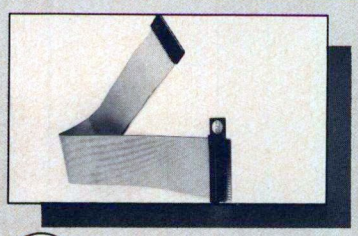

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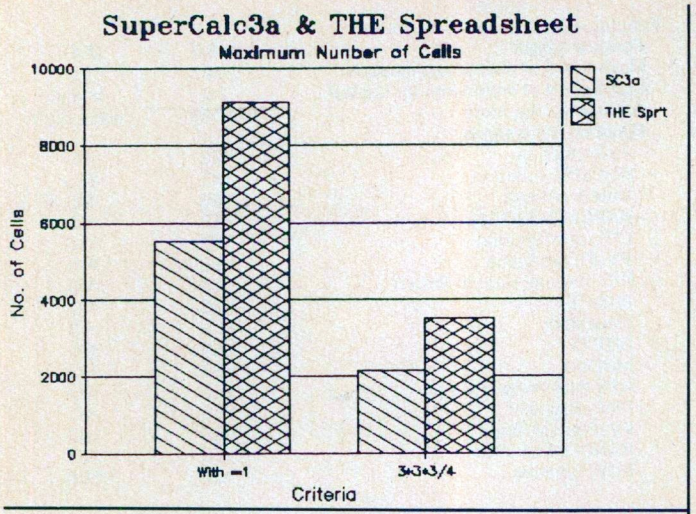
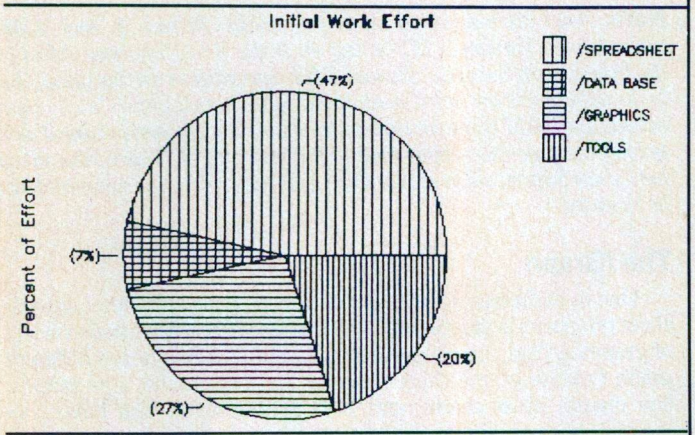
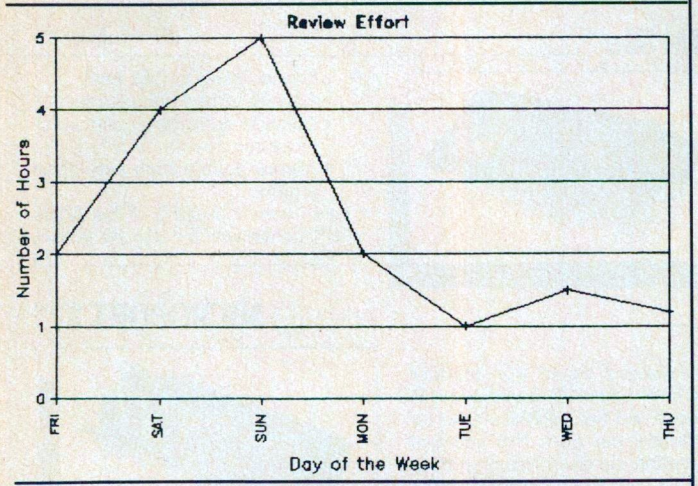






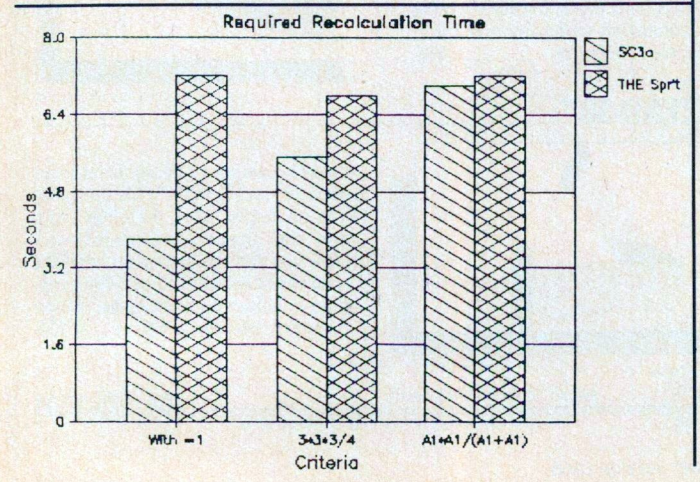


Figure 1

siderable flexibility in creating headings and using alternate font types when making hard copies. Figure 1 is an example of simple SuperCalc3a graphs produced on my Epson FX printer. Of course, if I had a plotter, the graph output would be much improved.

You can define many different graphs on the same worksheet. Each is easily created and can be viewed sequentially. Display time to view a graph is not bad. It took about 20 seconds to display the bar graph and 40 seconds to display the pie chart.

You have considerable flexibility in controlling the size of each plot. You can vary the plot size so that you may fit as many as four graphs on the same page. Of course, the larger and more complex graphs take longer to create. Production time for the bar graphs in Figure 1 required 5 minutes and the pie chart required 6 minutes. Using the whole page to print the same graph took longer—more than 17 minutes for the bar graph.

For those of you who need to use graphic power which is user friendly, this is a product to be considered seriously. You no longer need to create and transfer data through DIF files. Rather, the elements of the graph are defined right on the worksheet. A simple press of the /View command enables you to define all the elements (e.g., data block, main headings, sub-headings, labels, etc.) of the graph. All that remains is to press the Open-Apple key and 0 key. The graph is drawn quickly and displays fairly well using the double high-res capability of the Apple extended memory 80-column card. Once you get the graph the way you want it, a simple press of the Open-Apple and 9 keys will plot the graph on your printer or plotter. Any change of data in the worksheet changes the graphs. As long as you leave your /PROGRAM and /GRAPH disks in drive 1 and drive 2, respectively, movement between the worksheet and the graphic screen is easy and fun. By the way, when you save your spreadsheet, all values and graph definitions are saved automatically.

The /Program-Data Base

The implementation of the data base functions conform to the traditions of a spreadsheet. Each record is simply a row and each column becomes a field. In Release 1 you can have up to 253 records and as many fields as you wish or until you fill the memory.

Entered data are then defined as your input block. A different smaller area of the worksheet is then defined as a criterion block. Here you shall place your retrieval specifications. (Column headings—the first row of the input and criterion block—are used to define field names.) You may retrieve alpha or numeric data, use partial or complete matches, and, with data, use logical statements to test fields and data of the input block.

Once the input block is defined and the criterion values are entered, you have two options. First, you can select—SuperCalc3a calls this function FIND—a record stored in the input block. (This makes it easy to find a record and correct data entry errors since the marker is moved to the appropriate row.) Second, if you define an output block area in another part of the worksheet, then you can automatically extract all those records which meet the standards stated in the criterion block. Either all fields or only some fields from each record can be extracted and copied into this part of the worksheet.

If most of your data management work includes the generation of simple columnar reports with relatively few (less than 100) records and few fields for each record, then I recommend SuperCalc3a as an appropriate solution. You'll find that you'll master its data management subroutine in just half an hour.

The /Tools

The third diskette supplied by IUS includes a variety of programs which enable you to print wide reports SIDEWAYS, send and receive SuperCalc3 files to and from Apple/IBM compatible equipment, and convert/communicate with several other files and file types. For example, you can convert relatively easily—as long as you stay within the limitations of the SuperCalc3a program—all your VisiCalc, MagiCalc, and AppleWorks files to SuperCalc3a files and enter data files stored in DIF or comma delimited formats. Addi-

tionally, you can write to disk standard DIF files (although only row order DIF files are possible), comma delimited files, and standard text files, easily. All these file conversions are done through a supplemental program called SuperData Interchange Program. It's menu driven and easy to use.

What I Liked About SuperCalc3a

1. It's an easy to use, third generation spreadsheet package that gives you access to worksheets, graphics, and simple data base procedures.
2. When you enter a command, a press of a single key produces the complete command on the screen (e.g., /L produces /Load), and the complete name of each supplemental option is listed. This reduces the likelihood of making a mistake.
3. Editing an entry is easier than in VisiCalc—the movement of the arrow keys when in edit mode is more efficient than pressing ESC when you wish to delete characters.
4. Text larger than one column is displayed in empty adjacent columns, which saves a considerable amount of work.
5. Repeating labels can be entered in a single cell. These labels continue across all columns until a value or label is encountered in another cell.
6. It's easy to produce, define and change graphs.
7. Communication between Supercalc3a and other ProDos software is accomplished easily.

What I Didn't Like About SuperCalc3a

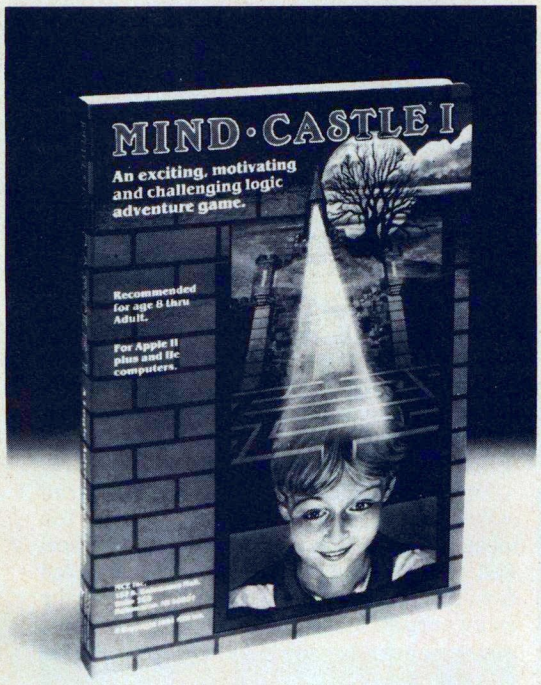
1. It is important to note here that each formula in SuperCalc3a is limited to 116 characters. I found this limitation frustrating.
2. Graphs may be generated on the screen or printed. They cannot be saved to disk as graphic images, or, at least no one at SORCIM/IUS could tell me how to accomplish it.
3. Some of the optional setting for using the program requires you to move between commands. For example, you have to move between the /Global command to set certain parameters for using graphics rather than using the /View command for all essential settings.

What's Missing In SuperCalc3a

1. The @Choose function. Of course, you can use a series of IF statements. Unfortunately, you have a good chance of reaching the 116 byte limitation.
2. Statistical functions such as variance, standard deviation, regression coefficients, etc.
3. DIF options which would allow one to save the data by rows or by columns.
4. Conversion of SuperCalc3a files back to VisiCalc files.
5. A greater support of a variety of printers and interface cards.

Conclusion

Because SuperCalc3a is a third generation spreadsheet package, you can achieve access to a sophisticated worksheet, a variety of graphics, and a simple data base management tool at a reasonable cost. For those of you who do not now own a spreadsheet package, or for those of you who want consistency between IBM and Apple products, or for those of you who are interested in easy access to a wide variety of graphics from a spreadsheet program without having to go through DIF routines, then this is a cost effective solution. (SuperCalc3a retails for $195.) Those of you with VisiCalc and/or THE Spreadsheet experience will find it relatively easy to master SuperCalc3a. I know that I have.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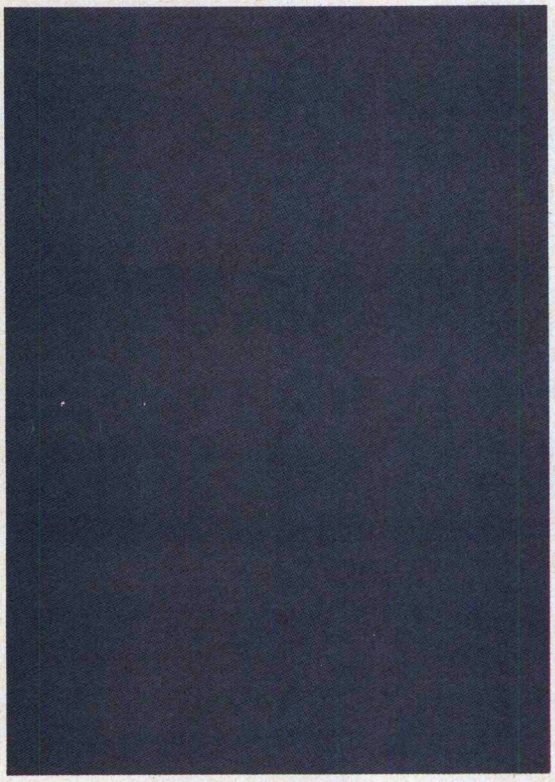
Review of Microsoft's "Excel"

The New King of Spreadsheets



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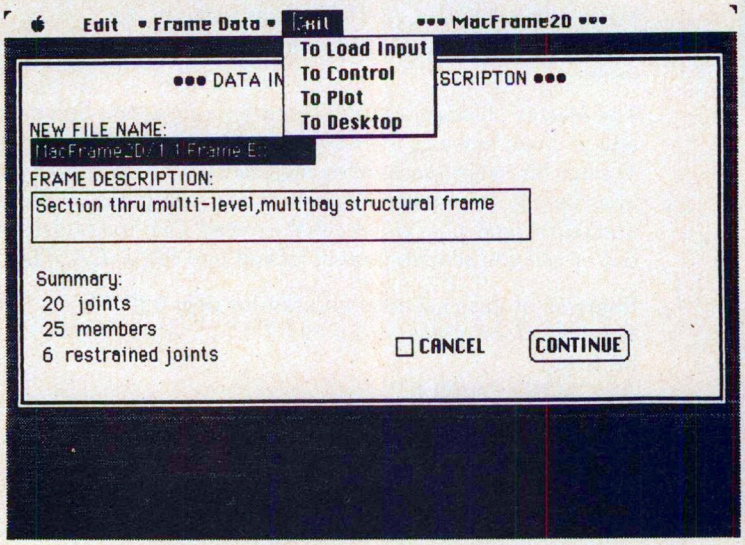
Richard P. Loggins

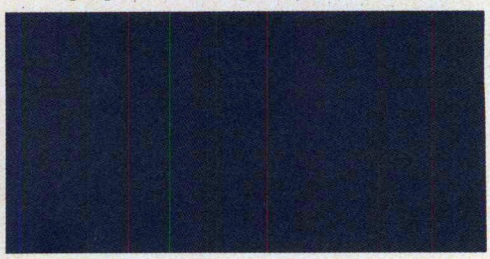
EXCEL is Microsoft Corporation's entry into the increasingly popular category of integrated software. It's a number-crunching powerhouse that includes excellent graphics, an above average database, and macros that exceed those found in any other spreadsheet. By capitalizing on the Macintosh interface, Microsoft has provided a product that's easy for the first time spreadsheet user to learn, yet with enough power and options to satisfy even the most discriminating user.

Getting Started

Supposedly, Excel is designed to run on a 512K Macintosh with a second disk drive and printer being optional—but recommended—luxury items. However, if you expect to approach anything near effective use, you'll definitely need the additional disk drive and printer. Otherwise, you can expect to spend most of your time switching disks.

Where backup copies are concerned, you can make as many copies of Excel as you need. You must, however, always use your original Excel disk the first time you start the program each day. This, in my opinion, effectively defeats the entire purpose of having a backup.





Starting Excel is virtually the same as starting any other program on the Macintosh: insert your disks, click the Excel icon, and Excel literally seems to jump out at you. There is also a document created each time you quit using Excel named "Resume Excel." By clicking this document twice, it will restore Excel to the state it was in just before you quit—nice touch if you work with the same documents continuously.

The Spreadsheet

Of all the spreadsheets currently available on any microcomputer, Excel is by far the largest: 256 columns by 16,384 rows, for an incredible 4,194,304 cells—almost twice the size of its nearest competitor.

But size isn't everything. Excel also includes a number of options that will let you change the appearance of either the entire worksheet or individual cell. Row and column headings and gridlines can be displayed or removed; you can display individual cells in bold, italic, or regular type; you can use any font of any size you have.

While I don't think anyone has given much consideration to using larger fonts, this option can be a godsend to anyone whose eyesight isn't exactly perfect. Additionally, you have the normal spreadsheet options of justifying text (left, center, right) and displaying dates and numbers in several different formats. If you don't like any of the standard formats, you can design your own.

When it comes to math functions, Excel is far beyond any other spreadsheet, even though it has fewer predefined functions than some of its rivals. If the eighty some-odd functions aren't enough or don't meet your particular needs, you can define your own by creating the calculation and assigning it a name, then use it as you would any other function.

While many programs limit you to one active spreadsheet per session, Excel allows you to open as many spreadsheets as you desire. The only limitation is the amount of memory your computer has. If you've increased the amount of memory on your Macintosh, you'll be able to work with more than the 5 to 20 worksheets that are typical on a 512K Mac, as Excel can accomodate up to 1 Megabyte.

Further, any open worksheet can be split into what Microsoft calls *panes* by positioning either of the small indicators anywhere on the horizontal or vertical scroll bars. A window can be split into as many as four panes, each occupying a portion of the video display.

Special Features

There are a number of special features you'll find extremely useful, the first of which I'll call *true integration*. This is the ability of one spreadsheet to refer to information on another spreadsheet. So if the sales in the Eastern and Western half of the United States were on separate spreadsheets named *East* and *West*, a third spreadsheet (named *Combined*) could use the following cell entry to provide the total sales.

= East!Total + West!Total

Anytime any of the sales figures on the East or West spreadsheets changed, it would be reflected automatically on the Combined worksheet. *True Integration.*

Another option is the ability to create what is called a Table. This feature lets you obtain the results of playing "what if" faster and easier than it's ever been done before. For example, you can compare two investments at interest rates ranging from 5% to 9% in 0.5% increments over a ten year period by simply specifying the original amounts and telling Excel which cells contain the interest rates. The results are displayed sequentially, to the right of each interest rate.

Perhaps one of Excel's most unique features is the ability to create and use *arrays*. Presumably taken from programming languages, an array is a matrix of cells that will simplify and enhance worksheets when you need to use multiple input values or obtain multiple values for results.

Consider the problem of determining the total value for three different products, each with a different price and quantity. In conventional spreadsheets, you would enter the price of each product into a cell (A1, B1, C1), the quantity of each into another cell (A2, B2, C2), and a formula into yet three more cells. Cell A3 would contain A1*A2; cell B3 would contain B1*B2; cell C3 would contain C1*C2. In cell A5 you could then use the function =SUM(A3;C3)to obtain the total value of all products.

By using an array, after entering the price and quantity for each product, you could enter the formula =SUM(A1*A2) into A5 and skip the three formulas in A3 through C3.

The Database

Excel's database is similar to the databases you'll find in many other spreadsheets, since it occupies a worksheet and has virtually the same appearance as a spreadsheet.

When you designate a portion of the worksheet as a database, the first row contains the field labels that are used to identify the contents of each column, which are celled fields. Each record occupies a single row, providing the same row/column format in a spreadsheet.

Any worksheet (or a portion of it) can be turned into a database by selecting the area and choosing a menu selection. Once designated, you have access to over twenty commands reserved exclusively for the database, as well as most of the commands and options used for spreadsheets.

Several different criteria areas can be established and activated at will, which can include computed criteria. Thus, using computed criteria with computed field entries lets you combine Excel's powerful data manipulation with its number-crunching capabilities.

When you are finished, a simple menu selection will turn your database back into a spreadsheet.

Graphics

Another of Excel's strengths is its graphics capabilities, which

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Microsoft calls *Charts*. A total of 42 different chart formats are available, organized into seven categories: area, bar, column, line, pie, scatter, and combination.

After choosing the type and standard format that is shown in a dialog box, you can customize any of the formats, and have complete control over the axes, tick marks, gridlines, and tick mark labels. Legends can be added and positioned at either the top, bottom, side, or corner of the chart. Titles, arrows, and other text in a variety of styles and formats can be placed almost anywhere you want to increase the effectiveness of your charts. You can also change the patterns, background, border and pattern weight through special menu selections.

Once you have your chart designed, it can be overlayed with another chart of a different type to provide meaningful comparisons. As you would expect, changes in any of the worksheet data are immediately reflected in the charts.

An added benefit is the ability to copy the chart as viewed on the screen, or as it will appear when printed, then paste it into something like a MacWrite document via the clipboard.

Macros

In most products that use macros, the macro is simply a series of keystrokes representing commands. These are usually placed in a portion of the worksheet, assigned a name, and cannot be used with any other worksheet unless they are copied. This type of macro is usually difficult to decipher or modify, and is usually limited in its functionality and portability.

The macro capability in Excel would have been better named a *programming language*, since it closely resembles the high level languages found in products such as dBase II and III. Microsoft even slips a time or two in the documentation and calls it a programming language.

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Excel's macros are created on their own macro sheet, and can be used with more than one worksheet without having to copy them. Combine this with the ability to have several macros on one sheet, several macros open at any time, the intelligent decision making capabilities of the macro language, access to almost every command in Excel, plus control over four different types of dialog boxes, and you have all the tools needed to create completely automated applications.

However, you do not have full access to all of the chart capabilities from a macro—something I feel could be improved. Why go through all of the trouble providing the best of everything you could ever want in an integrated software package, then drop the ball just before the goal line?

It should be noted, however, this is only a minor annoyance that will be of concern only to individuals developing advanced applications under macro control. Moreover, I believe this can be overcome (though not easily) and almost have the problem solved.

Compatibility

In addition to its own filetype, Excel is capable of supporting three others: Text files, (for communications, word processors and the like), SYLK files, (for almost everything written by Microsoft), and WKS files (produced by Lotus' 1-2-3).

In each of these, you aren't limited to simply importing the information as is the standard practice. With Excel, you can bring the information in, manipulate it, and put it back into any of the above file types — something 1-2-3, Jazz, Crunch, and all the others can't do.

Documentation

The documentation for Excel is provided in two separate manuals. The first covers operation of the spreadsheet, database, and chart functions, and includes a tutorial to help you get started. The second concentrates on arrays, functions, and macros, and is intended for the intermediate to advanced user.

Realizing everyone has ones own standards for determining the quality of documentation, I can only give my opinion: it's typical Microsoft documentation. Well written, fairly well organized, relatively good descriptions for each command, but leaving a lot to be desired. I feel it's intended for a person who has been exposed to a spreadsheet before, and is familiar with the operation of a Macintosh.

Depending on your level of experience, you may want to consider purchasing an entry level book. If you're new to spreadsheets and computers, one (by Doug Cobb) will be available from the Microsoft Press supposedly before the end of the year.

If you've seen a spreadsheet before, you might be interested in the book I wrote titled "Excel: Business Solutions for the Macintosh" from Addison-Wesley Publishing Company, which concentrates on how to provide integrated solutions in a business environment.

Audience

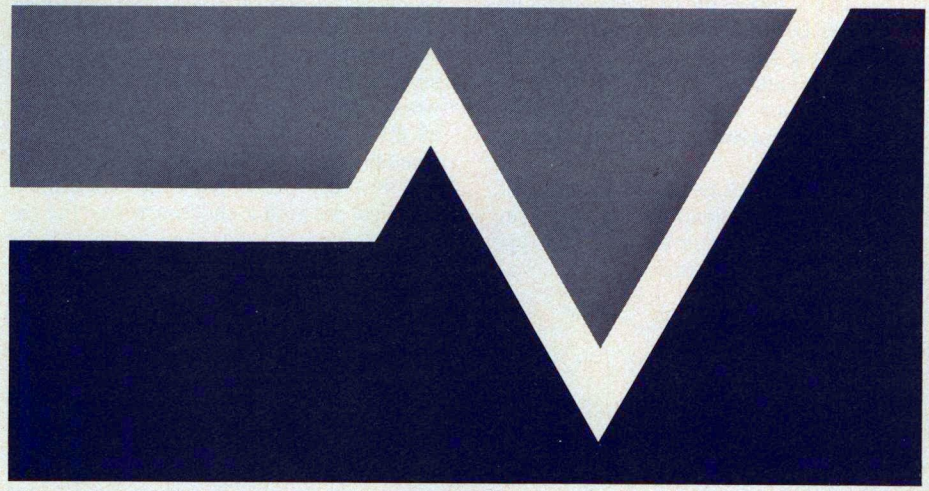
Excel is intended for the business user who is heavily involved with numbers, the same category that has been Lotus' 1-2-3 exclusive territory. Having had the opportunity to work with both products, and considering the ease of use and capabilities of each, I would venture to say that you'd be much happier with Excel than any other spreadsheet on the market—especially if serious number-crunching is of importance.

In fact, you may want to consider Excel as an alternative to any combination of individual programs providing graphics, database, and spreadsheet functions.

Conclusion

If, as has been said, Excel is "The World's Most Powerful Spreadsheet," I would have to agree. It's fast, loaded with almost every feature you could hope for, and is easy to use. Priced at $395.00, it's a better bargain than many near its class, and competitive with the rest. Its only real potential problem is exploring the tremendous number of options it provides.

A.P.P.L.E. Doctor



Bruce F. Field

APPLEWORKS & THE 80-COL. CARD

Last month I printed some information on intermittent problems with AppleWorks and the Apple extended 80-column card. I got a call from Diane Dresbach, a very nice lady at Apple Computer, who confirmed my published information. The problem is with the MMU chips in the Apple. Apple is replacing these so if you are having problems with AppleWorks and an extended 80-column card, *and* have an MMU chip with a date code of 8314, 8424, 8425, or 8426 you should contact the nearest Apple Service Center. (The Apple Service Centers are the regional centers set up by Apple; your local dealer may not be able to help you with this problem.) Diane also told me that they have found no problems with AppleWorks.

Ken Kashmarek wrote to say he also had a problem with AppleWorks and the extended 80-column card and the problem was fixed by AppleWorks version 1.2. Ken says:

"AppleWorks uses the AUXMOV routine to move data to and from the memory on the extended 80-column card. According to the documentation (*//e* Reference Manual), the soft switches must be set correctly or else this routine will not function properly. In particular, $C056 (hi-res mode off) must be hit before going to AppleWorks. AppleWorks does not set this switch before using AUXMOV. AppleWorks assumes that $C01D is less than 128 ($C01D is used to read the hi-res switch state). Bad assumption! Test it for yourself by using HGR, the TEXT, followed by '-APPLEWORKS' and try to load a file. Even small files use the extended memory."

I guess the bottom line is to make sure you have at least version 1.2 of AppleWorks if you are using the extended 80-column card.

MODIFY THE PRINT STATEMENT

Marilyn Emerson wrote to remind me how sequential files work on the Apple. A few months ago I had a program to save the date to disk and read it back later from another program. The critical line in the program to write the date was PRINT MO,DA,YR. Marilyn points out that the INPUT MO,DA,YR statement in the second program requires that the 3 items be written to disk separated by commas or carriage returns. However, the PRINT MO,DA,YR command does not supply the separators required by the input statement and thus the program will not work as intended. Instead, the print statement should be modified to be PRINT MO;",";DA;",";YR (or equivalently PRINT MO"," DA","YR since semicolons are not required between literals and variables) or PRINT MO : PRINT DA : PRINT YR. The first form prints commas between the entries, the second prints carriage returns. Either is acceptable. I deserve 20 lashes with a wet noodle for that oversight.

NULL CHARACTERS WITH APPLEWRITER

A number of people have written asking how to imbed control characters in word processing documents using Applewriter. The manual explains how to do this for most control characters except the null (ASCII 0) character. Unfortunately this character is needed to access special features of some printers (notably the Okidata printers). R. A. Royall has sent the following patch for the DOS 3.3 version of

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Applewriter *//e* to allow entering a null.

- Patch for entering NUL (Control-@) in Control-V mode, the only side effect being the DELETE key doesn't work for correcting keyboard input while entering a filename in the DOS COMMANDS or ADDITIONAL FUNCTIONS menu (use the left arrow key instead).
- Boot the DOS System Master disk. Remove the System Master disk and insert the Applewriter *//e* disk and type the following comands:

```
BLOAD OBJ.APWRT] [E
CALL -151
1CE1:EA EA EA EA
3EBA:EA EA EA EA
3D0G
UNLOCK OBJ.APWRT] [E
BSAVE
OBJ.APWRT] [E,A$1900,L$2F58
LOCK OBJ.APWRT] [E
BLOAD OBJ.APWRT] [F
CALL -151
1D81:EA EA EA EA
4033:EA EA EA EA
3D0G
UNLOCK OBJ.APWRT] [F
BSAVE
OBJ.APWRT] [F,A$1900,L$30D1
LOCK OBJ.APWRT] [F
```

I would strongly suggest that before doing this you copy both APWRT][E and APWRT][F to another disk using the FID file copy program. That way if you accidentally mess up the file you can always copy the original version back again.

BACKUPS WITHIN APPLESOFT

Bob Delaney was interested in a recent question and answer on making data file backups from within an Applesoft program.

"I recently uploaded files (June 85, BFF) to Compuserve which describe and implement a COPY command. COPY, which works only under ProDOS, can copy a text file, or any other type file, from anywhere to anywhere. When installed for a given session, it works from the Applesoft prompt or from within a BASIC program like any DOS command.

"You can find the files in the Apple 2/3 section of MAUG in data library 3 (DL3). COPY.HEX should be downloaded. When EXECed it BSAVES the machine language file COPY. BRUNing COPY installs the command.

"COPY.DES contains the description of the command. COPY.ASM contains the assembly language file.

"COPY is my work, which I have released with no restrictions on its use. Hope you find it useful."

Thanks Bob, I am sure we all appreciate your efforts.

USING ATARI JOYSTICKS

John Willis dropped me a note to update an answer I had on using Atari joysticks with the Apple. "Wico sells an adaptor at less than $20 that converts the Apple joystick port to two Atari joysticks. This works well for 2 player games (with about an 80% success rate). A good example is One-on-One. It puts one axis to one joystick and the other to a second joystick. It is more practical for young children where the expensive Apple joystick does not have to be placed at risk."

READING KEYS FROM APPLESOFT

Q. *I have an Apple //e and have not been able to find out how to program using either of the Apple keys by themselves or in conjunction with other keys. Also, I would like programming information on using the Delete key. My knowledge of machine language is severely limited, so I am most interested in Applesoft applications.*

A. All the keys on the keyboard with the exception of the Apple keys, caps lock, control, shift, and reset keys can be "read" from Applesoft with a GET (or INPUT) command. Each key is represented by a code number (an ASCII value). For example, in an Applesoft program if you type "A" in response to a GET T$ command, T$ will contain the letter A. If you then PRINT ASC(T$), you will get the number 65. The ASC function returns the ASCII code value of the first character of the string. There are 128 code values from 0 to 127. Of these, the first 32 are called control characters and do not print any character on the screen. The Delete key has a code of 127 and will print a checkboard block on the screen. This key does nothing by itself, but you can test for a Delete key press and use it any way you please in your program. The program below echoes all printable key presses to the screen and clears the screen whenever Delete is pressed.

```
100 GET A$ : A = ASC(A$)
110 IF A = 127 THEN HOME : GOTO 100
120 IF A = 13 THEN PRINT
130 IF A > 31 THEN PRINT A$;
140 IF A = 27 THEN STOP
150 GOTO 100
160 END
```

Line 100 gets a single character and puts the ASCII value in variable A. Then we check if A represents the Delete key in which case we clear the screen. Line 120 checks for a return key, and if it is we do a PRINT which does a carriage return and linefeed to the next line. If A is not a control character (line 130), then we print the character in A$ on the screen. Remember A$ is the character and A is a number, the ASCII value of the character. Line 140 checks to see if we pressed the ESC (escape) key and stops the program. If we left this line out, the only way to stop the

program would be to press control-RESET or turn the machine off. Pages 14 through 16 in the Apple *//e* Reference Manual contain the ASCII codes for the different characters and the key presses required to generate them.

The open-Apple and solid-Apple keys on the keyboard are different from the rest of the keys on the keyboard. These keys are not connected to the normal keyboard input but are wired to the pushbutton inputs on the game-I/O port. You can test whether these two keys are pressed by PEEKing at the two memory locations corresponding to pushbutton 0 for the open-Apple key, and pushbutton 1 for the solid-Apple key. If the value returned by the PEEK command is 128 or greater, the key is being pressed. The actual value is not important, only if it is 128 or greater. For example.

```
100 OA = PEEK(49249) : REM GET OPEN-
    APPLE
110 SA = PEEK(49250) : REM GET SOLID-
    APPLE
120 IF OA > = 128 THEN PRINT CHR$(7)
130 IF SA >= 128 THEN PRINT "BEEP"
140 GOTO 100
150 END
```

Notice that there are a couple of subtle differences in the way the keys work. When you use a GET to read the keyboard, you get exactly one response from the program until the auto-repeat feature of the keyboard starts sending more characters. With the Apple keys there is no repeat feature, but the program above keeps looping around as long as the key is pressed down. Also with the regular keys, if you press one and sometime later execute a GET, the GET will return the previously pressed key. Not so with the Apple keys. If you are not looking for a keypress when they are pressed, you won't see a keypress. Some joysticks may also interfere with the operation of the Apple keys.

MNEMONICS AND OPCODES

Q. *I am the owner of an Apple IIc computer with the new 65C02 processor. According to everything I have heard or read, the 65C02 has some additional new instructions. I am currently beginning to learn machine language on my computer and would appreciate it if you could list the mnemonics and opcodes for those new instructions and possibly a short explanation of each.*

A. The best source of information on the new instructions is a data sheet from one of the manufacturers of the chip. They are commonly available, for little or no cost, either directly from the manufacturer or a local manufacturer's representative. Another good source is a book by Gary Little, *Inside the Apple IIc,* published by Brady (Prentice-Hall) and it should be available at your local bookstore for $19.95. This book describes the 65C02, the ProDOS operating system, the Apple mouse port, and the built in serial ports. If you are serious about assembly language, you will probably want a book like this. There is also a monthly newsletter *Apple Assembly Line* that is devoted to assembly language programming on the Apple. It is published by S-C Software, P.O. Box 280300, Dallas, TX 75228, (214) 324-2050. They also have a good assembler that (if memory serves me correctly) supports the additional instructions and addressing modes of the 65C02.

The new instructions with their opcodes and addressing modes are:

Hex Opcode	Mnemonic	Description
80	BRA	Branch relative always [Relative]
3A	DEA	Decrement accumulator [Accum]
1A	INA	Increment accumulator [Accum]
DA	PHX	Push X on stack [Implied]
5A	PHY	Push Y on stack [Implied]
FA	PLX	Pull X from stack [Implied]
7A	PLY	Pull Y from stack [Implied]
9C	STZ	Store zero [Absolute]
9E	STZ	Store zero [ABS,X] - [Absolute, indexed]
64	STZ	Store zero [Zero page]
74	STZ	Store zero [ZPG,X] - [Zero page, indexed]
1C	TRB	Test and reset memory bits with accumulator [Absolute]
14	TRB	Test and reset memory bits with accumulator [Zero page]
0C	TSB	Test and set memory bits with accumulator [Absolute]
04	TSB	Test and set memory bits with accumulator [Zero page]

The new instruction addressing modes are:

Hex Opcode	Mnemonic	Description
72	ADC	Add memory to accumulator with carry [(ZPG)] [Zero page indirect]
32	AND	"AND" memory with accumulator [(ZPG)]
3C	BIT	Test memory bits with accumulator [ABS,X]
34	BIT	Test memory bits with accumulator [ZPG,X]
D2	CMP	Compare memory and accumulator [(ZPG)]
52	EOR	'Exclusive Or" memory with accumulator [(ZPG)]
7C	JMP	Jump (New addressing mode) [ABS(IND,X)]
B2	LDA	Load accumulator with memory [(ZPG)]
12	ORA	'OR" memory with accumulator [(ZPG)]

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F2	SBC	Substract memory from accumulator with borrow [(ZPG)]
92	STA	Store accumulator in memory [(ZPG)]

The jump instruction is the only instruction that has an absolute, indexed, indirect addressing mode. For example suppose the X-register contains the value $56, then the instruction JMP ($55AA,X) calculates an intermediate address by adding the contents of the X register to $55AA to obtain $5600 and then uses the contents of the two bytes at $5600 and $5601 as the effective (jump) address.

A DIFFERENCE IN CHIPS

Q. *I have a quick question. I have an Apple IIe with an extended 80-column card. What I want to know, can I put 256K memory chips on it and have the capability to use it like a Ramworks type card.*

A. The 256K chips have a different pin-out than the 16K chips so they are not a direct replacement for the 16K chips.

POKE 33,33

Q. *Quite by accident I found that POKE 33,33 will get BASIC to LIST in 80 columns to the printer. I am using a C. Itoh Prowriter with a Grappler interface but it may work with other interface cards as well. While writing this letter, I tried the following program.*

```
10 TEXT : HOME : D$ = CHR$(4) : PRINT
   D$;"PR#1": REM THIS IS JUST TO
   GET AN 80 COL LISTING
20 FOR I = 40 TO 33 STEP -1 : POKE
   33,I : PRINT "I =";I : LIST : NEXT I
40 PRINT D$;"PR#0" : TEXT : END
```

If I change the length of the REM statement in line 10, it changes the length of the first line for all but POKE 33,33. Can you explain this? In any event POKE 33,33 is quite convenient for me since I'm normally editing code when I need a listing and I also use it to keep from splitting up strings while recopying over an edited line.

A. The problem is an interaction between screen width and the way BASIC wants to list programs. When the width is greater than 33, BASIC checks to see if there is enough room on the line for a command; if not, it puts it on the next line. The magic number is 33. Once the screen width is set to 33 or less, BASIC stops checking for room on each line and outputs the program listing without any carriage returns. After 33 characters, the screen printing routine does issue a carriage return and line feed for the screen; but since it doesn't come from BASIC it doesn't get sent to the printer if one is on. Your solution should work for most interface cards.

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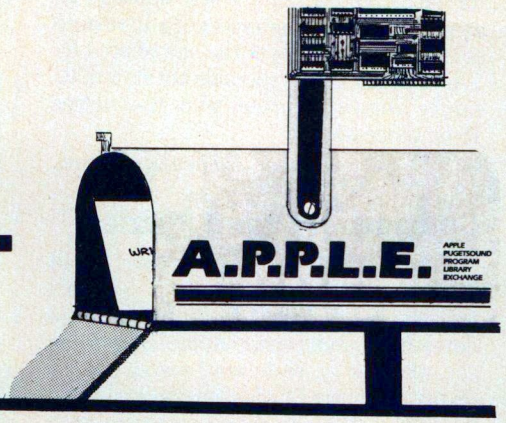

Readers' forum

Hardware versus SANE

Thank you for your feature section on the Apple's floating-point arithmetic in the July 1985 *Call -A.P.P.L.E.* James Thomas' article provides a comprehensive overview of the problems one can encounter when using the Apple for serious calculations and I greatly appreciated it.

However, while the article on Apple Computer's SANE package was interesting, I cannot agree with the opinion expressed in it, that "to do real (numerical) work.." all you need is SANE and "..the Apple II and III can still perform as the troopers they really are."

While there is no doubt that there are a lot of areas where the Apple's processing power is sufficient, extended precision floating-point arithmetic is certainly not one of them. To illustrate, I have taken some benchmarks, modeled as closely as possible (given the incomplete information) after the ones mentioned in the article, of a 68000 attached processor for the Apple manufactured by Digital Acoustics in Santa Ana. Timings were taken of Inter68 version 1.3, a Pascal system based on Apple Pascal using a 68000 p-code interpreter, and of HALGOL, an experimental threaded-code BASIC. For comparison, I included my own timings for standard Applesoft BASIC and the published timings for SANE.

All times listed are in milliseconds per operation, measured in a loop performed 1000 (for Applesoft) and 10000 (for 68000 Pascal and HALGOL) times and corrected for loop overhead, as was done in the article.

The 68000-based languages (not taking Pascal's single precision into account, which has insufficient accuracy for *any* kind of numerical work) are between 17 and 76 times faster than Applesoft and 28 to 633(!) times faster than SANE.

To illustrate what this kind of speed difference means for application programs, consider the case of a matrix multiplication and of the Fast Fourier Transform:

To multiply two N by N matrices, NM floating point additions and multiplications are necessary. To multiply two 50 by 50 matrices, about the maximum possible in Apple memory, SANE would need approximately 3125 seconds (a bit over 52 minutes) to perform the calculations alone, while the 68000-enhanced Pascal would require about 37.5 seconds and HALGOL 21.3 seconds (actual execution times are about twice as long due to loop overhead).

For a 1024-point FFT (1024*LN(1024) = 7098 additions and multiplications), the calculation time would be about 177.5 seconds for SANE compared to 2.1 seconds for 68000-Pascal and 1.2 seconds for HALGOL.

Test	SANE	BASIC	68000 Pascal single	68000 Pascal double	HALGOL
A + B (est)	6	2.4	0.079	0.125	0.069
A*B	14	4.3	0.099	0.175	——-
C*D	19	——-	——-	0.177	0.101
SIN(PI/6)	217	27.4	0.669	1.596	1.261
EXP(6)	256	24.9	0.467	0.490	0.986
ATAN(.5)	327	39.3	0.491	0.516	1.140
SQRT(AMZ + BMZ)	149	144.6	2.515	5.260	4.938

A = 123456789E10; B = 987654321E5; Z = 1.23;
C = 123456789E100; D = 987654321E100;

Notes:

68000 Pascal: double precision has 15 decimal digits. HALGOL: double precision only, 14 decimal digits.

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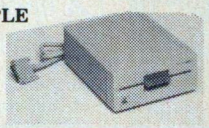

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I think the timings and examples clearly show that for a business or scientific environment (obviously the intended market for the SANE package), where time as well as precision is of the essence, a hardware solution is preferable to the one offered by SANE because the venerable but slow 6502 simply *cannot* compete with the newer 16-bit processors.

Thomas Wieland

Spreadsheet Word Puzzles

You may be interested in a novel use of THE Spreadsheet. My wife is a school teacher and I don't have much time to develop programs on my Apple *IIe*, so when she asked me to create word-search puzzles on my computer I had to find an easy way.

The method involves establishing a Spreadsheet file which I called Wordbase. This Spreadsheet consists of randomly entered letters. The number of rows and columns can be varied to suit the desired size of the word puzzle. The Spreadsheet can be established quickly by typing in a few rows or columns and then enlarging the file by using the copy column or row facility and editing random elements.

"Puzzle" File

```
W S E A E A C O D E A E Z E A D C Z A D
S E S P I O N A G E G D F W G S F F I S
G C A D Y D B U M D G V D V S D E S I A
B R F P G F B Y F E F G Y F F B G Y S B
U E S E O E D D H R R B D M E U U S E X
L T B B J N N B E N B A B B I L I B B L
N I R F E F O V A I F I I S F S Q I F T
I D K A M K O D F C D M E K T I S D D C
F F K M I C R O F I L M F A V F F I V A
K X L X S L H X H P X S N L X K H X O T
X S T H V H E S A H C T S V H X X S H N
H G O R K V U G A E N E M Y S H U G S O
F O R I A I L O M R B S C S X P L C I C
Y O U R D C T G T D G D G A G A T G G T
U E Y E S X K E S U O H E F A S A B K U
E K O N L Y R K R N M N K P M S R K M E
B E Q B Q W B E B B B Q E Q B P B E B B
A M T V S V T N E G A E L B U O D M V A
Z E X T E R M I N A T E M D B R X C A Z
A I Y J V Y N O I T A C I F I T N E D I
```

The words used to form the puzzle are then entered in another Spreadsheet which I called Wordkey. This Spreadsheet contains blank elements except where the letters are located to make up the puzzle words. The theme of my puzzle was Spies.

"Wordbase" File

```
B Z E A E A C D C I A E Z E A D C Z A D
S F W G D S F F F S G D F W G S F F G S
G D O D P D B D V D G V D V S D E D I D
B Y F F G F F Y F A F G Y F F B F Y F B
U D U E A E D D H U L B D R E T U D E X
L B B B J H N B S N B J B B B L N B B L
N I U F E F O I A I F I I I F I O I F I
I D K D M K F D F M D M D K D I F D D I
F F K V K V F F F F V K F K V F F F V F
K X L X S M H X H S X S X L X K H X X K
X S V H V H X S X X H V S V H X X S H X
H G O S K V U G A K S K G O S H U G S H
S O G I K I L O M O B S C S X O L C I O
T G A G D G T G T D G D G A G T T G G T
U B W K W X U B U D K W B E K U A B K U
E K P M N M R K R N M N K P M E R K M E
B E Q B O W B E B B B Q E Q B B B E B B
A M T V S V O M O S V S M T V A O M V A
Z C D C D T D C H Z J D M D B Z X C A Z
A I Y J V Y A R A X S Z W S S V A W S A
```

The final step is to superimpose Wordkey over Wordbase to create a third Spreadsheet which I called Puzzle. One word puzzle created in three easy steps.

"Word Key" File

```
W S       C O D E                 D
  E S P I O N A G E             I
  C A   Y     U M               S   A
  R   P     B     E           G   S
  E S   O       R R     M   U   S
  T       N     E     A     I   I
    R           V           S   S       T
        A       O     C     E   T   S     C
        M I C R O F I L M     A       I   A
              L       P     N           O T
    T         E S A H C T               N
      R               E N E M Y         O
F O R   A             R           P     C
Y O U R   C                       A
  E Y E S   K E S U O H E F A S
    O N L Y                     S
                                P
              T N E G A E L B U O D
  E X T E R M I N A T E         R
              N O I T A C I F I T N E D I
```

Additional word puzzles can be easily established by editing Wordbase or by establishing a larger Wordbase file and selecting different portions of Wordbase each time, thereby avoiding repetition of the base pattern. As the name suggests, the Wordkey files are the key to solving the puzzles.

Tom Yelland

Caveat Emptor

I am writing this letter so that others will not have the same misfortune as myself. In early March, I ordered MegaTask+ from Quantum Leap Technologies. When the company did not acknowledge my order after a month, I called to see if they had received it and to get an expected shipping date. I called three to five times a week for a month and only reached the answering service. Even though I left my address and home and business phone number, I did not receive a reply, only my canceled check. Eight weeks after ordering, I sent Quantum Leap a letter requesting a refund. It is now three months later and I still have neither the product nor a refund.

Jack Cook

Down on Apple

I am writing in response to your request for comments on the "Quincy Flugelheidt" article about Apple Computer in the July 1985 issue.

The shakeup in Apple was long overdue and is probably too late. Too many of the best people are already lost.

I bought my Apple II in May of 1980. Many visits to swap meets and the judicious use of mail order suppliers have enabled me to stave off obsolescence. This has been not only without help from Apple, but in spite of them.

I found their campaign against mail order sales a personal insult. I live in the middle of the California desert. There is no one within 100 miles I would trust to plug in a card.

Apple has made no attempt to improve the performance of my machine. In fact, every effort has been to render it, and any

software I have, obsolete. They have produced three new machines beside the II series and not one was truly compatible with the others.

They are currently trying to sell a closed box with half a keyboard and non-standard outputs in both their remaining lines. Why anyone would buy a constantly evolving piece of equipment with closed architecture is difficult to understand. With the track record Apple has, it's almost suicidal. I am writing this using "Wordstar" on CP/M in 80 columns, using a detached keyboard with a numeric keypad that produces upper and lower case. When I am finished I will print it out to an "Epson" printer using a standard "Centronics" parallel connector. I will buy nothing without slots, lots of slots.

Classic Apple merchandising is well displayed by the new "UNIDISK" on page 49 in the Marketplace section of your July 1985 issue. In today's market, to even offer a new drive with only 143K storage is ridiculous. To charge $329 plus $100 for the controller card and only offer a 90 day warranty is a blatant abuse of brand loyalty. On the facing page (48), "VF Associates" is offering disk drives for $129. "JDR Microdevices" sells drives with a one year warrantee for $140. Drives with 326K sell for around $320.

Steve Wozniak was quoted in "Personal Computing" as stating that, "We could have let the Apple II evolve. We could have added the accessories to make it do the business functions that the outside world is going to IBM for." Mr. Wozniak is a brilliant man, and it's too bad there was no one at Apple listening. I think when I am finally forced to cash in my old II, I'll go to IBM too.

William G. Ingersoll, Jr.

Bugs Again

I believe I have found a bug in ProDOS Version 1.1.1. It also may be in Version 1.0, but I have not checked. The problem is in the CHAIN command of the basic interpreter. Sometimes the program will hang after the new program is CHAINed into the computer. After many hours of dissassembly and study, I believe I have found the bug. The following description applies to ProDOS Version 1.1.1 only. I do not know the equivalent locations of Version 1.0.

The problem lies in the subroutine at $A37F. This is the copy up routine for the variables and arrays. The dissasembly is as follows:

```
A37F-  AC 92 BC   LDY   $BC92    CHECK FOR PARTIAL PAGE
A382-  F0 07      BEQ   $A38B    NO — COPY ONLY FULL PAGES
A384-  20 96 A3   JSR   $A396    YES — COPY PARTIAL PAGE FIRST
A387-  C6 3D      DEC   $3D      DECREMENT PAGE TO STORE TO
A389-  C6 3B      DEC   $3B      DECREMENT PAGE TO STORE FROM
A38B-  CC 93 BC   CPY   $BC93    IS PAGE COUNT 0?
A38E-  F0 0E      BEQ   $A39E    YES — DONE — RTS
A390-  CE 93 BC   DEC   $BC93    NO — DECREMENT PAGE COUNT
A393-  4C 84 A3   JMP   $A384    AND GO COPY NEXT FULL PAGE
-------------------------------------------------------------
A396-  88         DEY
A397-  B1 A3      LDA   ($3A),Y  SUBROUTINE TO COPY NUMBER
A399-  91 3C      STA   ($3C),Y  OF BYTES IN Y REGISTER
A39B-  98         TYA            FROM LOCATION AT $3A $3B
A39C-  D0 F8      BNE            TO LOCATION AT $3C $3D
A39E-  60         RTS
```

The problem arises when the total bytes to be copied make up an exact multiple of even pages. If there is not a partial page to copy at $A382, the program branches to $A38B. This has the effect of copying the page above the arrays into the bottom page of the strings. The solution is simple. Just change the branch at $A382 from $07 forward to $03 forward.

This can be done several ways. From the monitor, type A383:3. From BASIC type POKE 41859,3. You can also make permanent changes to the BASIC.SYSTEM on the ProDOS diskette. I have chosen to add the command POKE 41859,3 to all my startup programs.

```
10  I = 1:J = 1:MO = 1:DD = 1:YY
    = 1:MM = 1:MP = 1:Z = 1:X0
    = 1:A = 1:X = 1:X3 = 1:Y0 =
    1:X4 = 1:Y1 = 1:X1 = 1:X2 =
    1:C = 1:B = 1
20  SU(1) = 1
30  DIM L(4,17),H(4,17),K(4,17)
40  DIM P$(60),P(130),P1(10),P2(10),P3
    (10),P4(10),P5(10),P1$(60),IL(50),
    IL$(20),ST(18,7) ,DP(3,11),DQ(3,12)
50  DIM O1$(1),O2$(1),O3$(1),
    O4$(1),O5$(1)
55  FOR I = 1 to 60:P$(I) =
    "AAAAAAAA" NEXT I
60  GET O1$(1): PRINT
100 PRINT CHR$ (4):"CHAIN TWO"
```

Program 2

```
10  TEXT : HOME
20  PRINT SU(1)
```

See the short program that will hang up with the CHAIN command. It is actually two programs that CHAINs from program one to program two. I hope this can help someone who has experienced this problem.

Oliver Mayes

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Both versions include a six page user manual and will run on Apple II, Apple II+, Apple IIe and Apple IIc.
Source Version also available for Macintosh if you have Microsoft BASIC.
Please add $2.00 shipping and handling to all orders.
(California residents please add 6½% sales tax)

ARTIFICIAL INTELLIGENCE RESEARCH GROUP
921 North La Jolla Avenue, Dept. X
Los Angeles, CA 90046
(213) 656-7368 (213) 654-2214
MC, VISA and checks accepted

Circle 61 on Reader Service Card

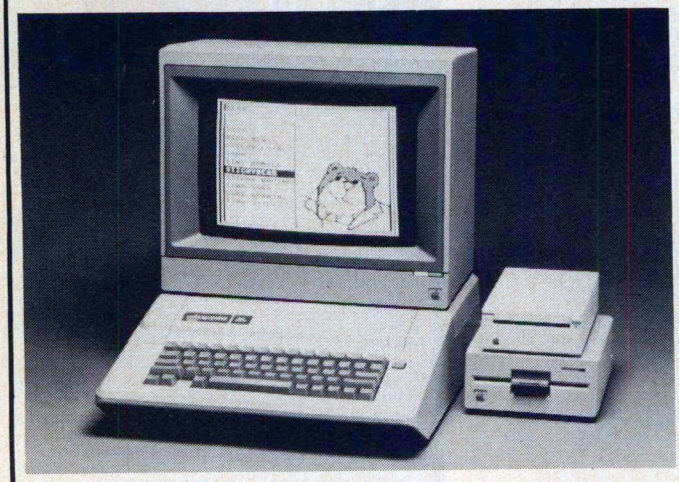
THE MARKETPLACE

The following items are selected by our editorial staff from the large number of product announcements and news releases sent to us daily. They are presented solely to keep you informed about the current market for Apple related hardware and software. As we have not tested many of these products, appearance here does not necessarily represent endorsement or recommendation by A.P.P.L.E. Further information about items appearing in The Marketplace can be obtained through the Reader Service Card. If you contact any manufacturers directly, please mention that you learned about them in *Call-A.P.P.L.E.*

COLORFUL, NEW PERIPHERALS FROM APPLE COMPUTER

Renton, Washington—September 17, 1985—Apple Computer, Inc. today announced several new peripheral devices for the Apple II family, and company representatives demonstrated these exciting products to an overflow crowd at A.P.P.L.E. Co-op headquarters.

HI-RES COLOR MONITORS



The ColorMonitor *//e* and ColorMonitor *//c* are composite, 13-inch color monitors that can display high-resolution color directly from the standard video output jack of any Apple II without an RGB adaptor, and can also display 80 columns of text clearly in monochrome mode. At $399 retail, both models are identical except for the shape of the case, and the *//c* version can be mounted on an optional $25 stand. These monitors replace previous color monitors in Apple's line.

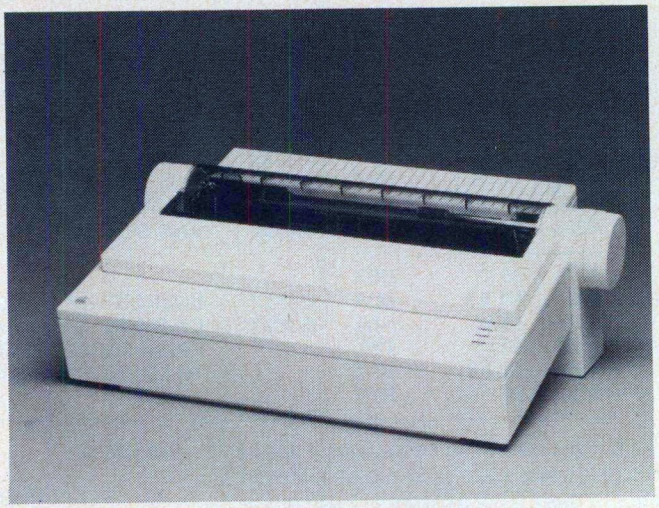
NEW 300/1200-BAUD MODEM FROM APPLE COMPUTER

The Apple Personal Modem is an intelligent, Hayes compatible model that transmits up to 1200 bits per second. Its compact case is designed to plug directly into a wall electrical outlet to reduce desktop clutter, and it can be connected with an appropriate cable to any computer's RS-232C serial port. It has auto-answer, auto-dial, and auto-redial capabilities, as well as an internal speaker and indicator light for monitoring transmission status. Retailing for $399, the Apple Personal Modem replaces the Apple Modem 1200. However, the 300 bps Apple Modem 300 ($225) will continue to be available.

NEW 800K, 3½-INCH DISK DRIVE

The UniDisk 3.5 uses double-sided, 3 ½-inch disks with a total formatted capacity of 800K, and operates up to 50% faster than standard Apple 5 ¼-inch drives. For the *//c*, a required ROM modification will be provided at no extra charge by Apple dealers. For the Apple II, II +, and *//e*, an accessory kit must be purchased for $69. Retail price of the UniDisk 3.5 is $499.

COLOR IMAGEWRITER



The ImageWriter II, which succeeds the popular ImageWriter, provides faster speed, improved print quality and paper handling, color printing capability, and an expansion slot for a 32K memory buffer ($99) and other possible options. Three speeds/modes are selectable by external button on the printer: 250 characters per second in draft mode, 180 cps in standard mode, or 45 cps in near-letter-quality mode. Color is produced by an optional, 4-color, reusable ribbon cartridge ($13.95), operating under appropriate software. An optional SheetFeeder ($225) can automatically load up to 100 individual sheets of paper. At $595 plus $29.95 for connecting cable, the ImageWriter II is priced about the same as its less capable predecessor.

RESEARCH DATA ON THE APPLE

NUMBER COMMANDER is a powerful, easy to use Database, Statistics and Graphics package for the Apple computer. The screen displays clearly lay out the available options, and also display the corresponding page number in the manual if questions arise. All the disks (2 program disks, 1 example/tutorial disk, and 1 data disk) are copyable.

This software package contains several different programs features:

- *Database:* Up to 29 named variables per file, up to 10 files per disk. Over three hundred to thousands of data sets per disk, depending on the number of variables. *Instant recall* of any particular data set for calculation, review, change, printing, etc.
- Files can be expanded, split, reorganized, sorted, and transferred at any time without loss of data. The fast sorting routine can use 1, 2, or 3 variables.
- Data can be tabulated as entered or in any sorted sequence, printed, placed on disk for use with a word processor, telex, etc.
- The *High Resolution Screen Plot* program reads data from disk as entered or as sorted, then operates with data in memory and lets you quickly plot anything against anything. You can use linear and logarithmic scales in any combination. If you want regression lines and regression equations, it's there too (with regression equations, error estimates, etc.) Graphs can be superimposed, printed, stored on and retrieved from disk.
- *Plot on the printer* creates professional-looking graphs with up to nine variables and up to nine ratios or products, each with its own automatically selected plotting symbol.
- *The Screen Plot* section of NUMBER COMMANDER does simple linear, logarithmic, exponential, and power function regression.
- Correlation Matrix and Stepwise Multiple Regression operates with data in memory and up to 29 variables. Fast computation of simple and multiple linear regression equations is available between any two, three, or four of these variables.
- *General Correlation and Curve Fitting* package operates over any number of data disks. Up to nine independent simple variables plus up to nine independent ratios or products of variables can be entered as linear, logarithmic, exponential, and power functions of the stored variables for correlation analyses and for purposes of fitting non-linear functions to stored data.
- *Manual Multiple Linear Regression Analysis* is the perfect quickie for a modest amount of data.

This package requires an Apple *IIe* with an 80-column card, or an Apple II + with a language card and a Smarterm or compatible 80-column card, two disk drives, and a printer with a Grappler + or compatible interface card.

ComputerEase, Inc., 1312 West Cedar Street, Appleton, WI 54914, (414) 739-7751.

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YOU OUGHTTA BE IN PICTURES

TAKE 1 is Hollywood Magic on a floppy disk and you are in the director's chair. Imagine writing, producing, and directing your own computer movies. Whether magical illusions or special effects. . . cartoons, school reports, or business briefing, only you can decide, for the script is yet to be written.

The creators of TAKE 1 present "You Oughtta Be in Pictures — The Contest" to give you a chance to show off your creativity and win valuable prizes. Send in your best movie created with TAKE 1 on your Apple computer. You will be eligible to win and choose from hundreds of computer products for your home or school.

Panel of Judges

- Steve "Woz" Wozniak; Co-Founder, Apple Computer
- Bob Singer; Art Director, Hanna Barbara Productions
- Vibeke Sorensen; Educator/Animator, California Institute of Technology, California Institute of the Arts
- Maggie Canon; Editor, A+ Magazine

Send Now For Details

To get started, send now for entry rules and forms. You can also order the TAKE 1 Tips Disk and a full-color "You Oughtta Be in Pictures" poster.

Baudville
1001 Medical Park Drive S.E. Grand Rapids, MI 49506
(616) 957-3036

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COMPUTER BINGO AND SCRABBLE

Bingo

Play Bingo with your computer and friends or family. A printer is required for printing the "BINGO" cards. Sixty bingo cards can be printed at one time, two cards per sheet. The game rules are identical to "Bingo." The numbers for printing the card and for "calling" numbers are generated by a random number generator.

The monitor displays which number to call under which Bingo letter. All numbers are stored in a file. When "BINGO" is called by a player, the computer checks all called number and verifies the winning numbers. A new game can start immediately using the old cards or if desired, new cards can be printed with different numbers. Cards can be printed at any time.

For the Apple *IIe* or *IIc* computers with printer and one drive. Price: $26.50 (includes hard plastic 3-disk storage container)

Scrabapple

A computerized version of the SCRABBLE game incorporating a "crossword" grid as the playing board, it is designed for 1 to 4 players. The monitor displays the playing board, the current player's name, total points earned, and the current player's letter selection. The letter selection consists of 10 letters of the alphabet randomly selected by the computer and the point value for each of the letters.

When a player selects letters to form words, the letters are transfered to the crossword grid and are deleted from the player's selection. As the letters in the player's selection are used, the computer randomly selects letters to replace all used letters. The object of the game is to "hook" a word onto a word already displayed on the screen, similar to the crossword and scrabble game procedures. Player's accumulate points for each letter of the word placed on the crossword grid. The game ends when no more words can be placed on the grid. The player with the highest points wins the game. Price: $26.50. For more information on other games and software contact:

Inkspot Graphics, 11516 N. Port Washington Rd., Mequon Office Park, Garden Level, Mequon, WI 53092, (414) 241-4944.

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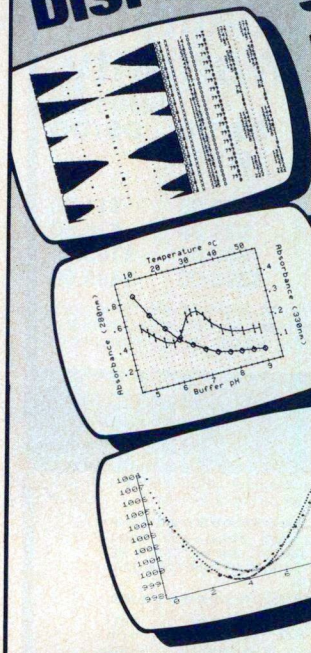
APPLE*II DATA ACQUISITION DISPLAY & PLOTTING SOFTWARE



LAB DATA MANAGER software for chromatography, spectroscopy and many other applications. Includes: **DATA ACQUISITION:** samples A/D input from 1 to 16 channels; **MEMORY MANAGEMENT:** extra RAM cards can store up to 32K samples per channel; **FAST DISPLAY:** 4 data sets of 1024 points with zoom and scrolling in 4 directions; **STRIPCHARTS:** turns your printer into a 4-pen chart recorder that prints both graphics and text; **DATA PROCESSING:** operates on large data sets; e.g., differentiate, subtract baseline, integrate peaks. **$250**

SCIENTIFIC PLOTTER — Draws professional-looking graphs of your data. You choose data format, length and position of axes, 20 symbols, error bars, labels anywhere in 4 orientations. Includes 5 demos on disk plus 30-page manual **$25**

[For DIF file or plotter adaptations (Hewlett-Packard, Apple, Houston Instrument) add $25 for each option.]

CURVE FITTER — Select the best curve to fit your data. Scale, transform, average, smooth, interpolate (3 types). LEAST SQUARES fit (3 types). Evaluate unknowns from fitted curve. Includes 5 demos on disk with 33-page manual . . **$35**

ORDERING INFO — Add $2.50 shipping on all U.S. orders. VISA or MASTERCARD orders accepted.
*Trademark of Apple Computer, Inc.

Write, call or Telex for our latest catalog!

iwi **INTERACTIVE MICROWARE, INC.**
P.O. Box 139, Dept. 48, State College, PA 16804
Phone: (814) 238-8294 • Telex: 705250

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MacinPlace

CUT MACINTOSH INPUT TIME

Assimilation, Inc., announces Numeric.Turbo, a full function numeric keypad/high speed input device for the Macintosh. It combines a full-scale numeric keyboard with Assimilation's Mac Turbo Touch peripheral—a high speed "trackball" cursor controller that reduces present Mac input time by more than 50%.

Compatible with Jazz, Excel, Ensemble, Quartet, and Dollars and Sense, the Numeric Turbo attaches to either side of the main keyboard with velcro strips, making it easy to use for both left and right hand operators. It is also compatible in a network situation. Price: $149.

Assimilation, Inc., 485 Alberto Way, Los Gatos, CA 95030, (408) 395-7679.

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Assoc.	Case of 100	$83.00	$103.00
Brand	Carton of 500	$395.00	$495.00

(Includes hub rings, white Tyvek sleeves, blank labels; thick sturdy diskettes, fully certified error free: surfaces of such high quality they retain data even from drives emitting signals 25% below normal strength!!!!)

DISTAR Disk Drive for II. IIe. IIc . . . $119.00
STANDARD PARALLEL (!) printer interface for IIc . . . $55.00
Full Feature Printers . . . from $189.00

COD and Visa/MasterCard orders welcome. UPS SHIPPING: $4.00 per order plus $6.00 per printer or monitor.

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NEW MACINTOSH HARD DISK FROM APPLE

Apple Computer, Inc. has announced Hard Disk 20, a 20-megabyte hard disk for the Macintosh 512K. This 3½-inch Winchester drive connects to the disk drive port on the back of the Macintosh. Designed to fit under the computer without increasing its "footprint," the drive is only 3 inches high and has the same width and depth as the Macintosh itself. An external port on the hard disk can be connected to a backup tape device, an external floppy disk drive, or another hard disk. The Hard Disk 20 is scheduled to be available by early 1986.

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MAC-BARCODE

Mac-Barcode software enables Macintosh users to generate bar codes for label printing or creating worksheets. The software features pull down menus for choosing bar codes (128, 39, 2 of 5, Codabar, UPC, 93, 11), symbol height, bar spacing, and vertical or horizontal presentation. Users will also be able to easily construct worksheets with text selections of various fonts, point sizes, font styles as well as various label sizes. These combined features enable Macintosh users to meet the requirements of the automotive, health care, food processing and packaging industries, the U.S. Department of Defense's LOGMARS programs as well as custom applications.

Price: $395. *Computer Identics, 5 Shawmut Rd, Canton, MA 02021 (617) 821-0830.*

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CONSTRUCT PAPER AIRPLANES

THE GREAT INTERNATIONAL PAPER AIRPLANE CONSTRUCTION KIT is now available for the Macintosh. The program is based on the best selling book which has been the source of contests, films and even doctoral theses.

THE GREAT INTERNATIONAL PAPER AIRPLANE CONSTRUCTION KIT is a set of paper airplane templates and a library of airplane graphics. The CONSTRUCTION KIT contains over a dozen full page paper airplane designs from biplanes to space shuttles that can be embellished on the wings and fuselage with aeronautical art. The planes can be customized with a variety of insignias and ornamentation. The library of aviation graphics can be used to furnish planes with insignias, logos, rockets, windows, engines, pilots and even stewardesses.

The suggested retail price for the Macintosh version is $39.95. The Apple II version is available for $34.95. THE GREAT INTERNATIONAL PAPER AIRPLANE CONSTRUCTION KIT can be purchased at computer specialty and consumer electronics stores, mass merchandisers, and book, toy and video outlets.

Other enhancements include the simultaneous display of stellar objects and astronomical data, and incorporation of pull-down menus to locate and identify objects, change the viewing direction, and access utilities.

TELLSTAR will also provide viewers information on Halley's Comet, star clusters, galaxies, nebulae, and constellations. Halley's Comet is expected to be visible during 4th quarter 1985 by telesocope and, beginning 1st quarter 1986, with the naked eye.

TELLSTAR Level I is priced at $49.95 and includes all basic functions and one star table. Level II, with three detailed star tables, is priced at $79.85.

Spectrum HoloByte Inc., 1050 Walnut, Suite 325, Boulder, CO 80302, (303) 443-0191.

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STRUCTURAL ANALYSIS SOFTWARE

MacFrame2D uses stiffness matrix method to analyze two dimensional structural frames. MacFrame2D's ease of input, storage, and editing of frame and loading data make it a useful tool for projects within its scope of 20 joints and 30 members.

The program derives its ease of use through the liberal use of familiar Macintosh features. These features, such as pull down menus and edit fields, simplify execution for infrequent users and will prove to be efficient for frequent users such as engineers, structural designers, and students.

User may verify frame geometry using the screen plot with numbered joints. Printed output includes joint and member input data, member end forces and moments, deflections, reactions, and optional frame plot. MacFrame2D comes complete with operation manual including examples. Price: $150.

Design Source Software, P.O. Box 91219, Houston, TX 77291-1219, (713) 820-7026.

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Renton, Washington 98055

TRY IT YOU'LL LIKE IT -HEGIRA-Tale of A Galactic Exile is a science fiction Adventure game for the Apple II family. It was written by a Programmer who has written science fiction. We think you'll like it if you try it. Send $7 for the diskette alone, $9 for the rules or $15 for both. Game testers loved it! Ted Butler, 14635 SE 266th St., Kent, WA 98042. Washington state residents add 7.8% state tax.

MOUSETRACER—Use your Mac *//e*, or *//c* mouse and draw like the pros! Put cartoons, pictures, maps, etc. on the drawing board. Strap your mouse to the Mousetracer and with your favorite graphics program trace the picture of your choice. Works like a 1:1 drafting board pantograph. Send $34.95 + $3 UPS shipping (CA res add $2.10 sales tax) to: Brimark Innovations, 9821 Yolanda Ave. Northridge, CA 91324.

CAPTAIN—Computerized Cognitive Rehabilitation Training System-21 programs for training skills in the areas of attention, concentration, visual, motor, conceptual and memory. Apple II + or Apple *//e* 64K required. For more information call Richard Browne, Ph.D.: (804) 379-2253.

SUPER TRIVIA PRODUCTS—EDUCATIONAL TRIVIA: Categories: American History, Popular + Classic Literature and General Knowledge. Over 1,500 questions, 3 diskettes, $39.95. ENTERTAINMENT TRIVIA: Categories: Super Potluck, Movies + TV Marvels and Sports Sensationals. Over 1,500 questions, 3 diskettes, $39.95 SCIENCE FICTION TRIVIA: From Sci-fi classics to Star Trek and beyond. Over 1,000 questions, 2 diskettes, $29.95. NEW AGE TRIVIA: Categories: Rock 'N' Roll, People, Places and Things. Over 1,000 questions, 2 diskettes, $29.95. HEALTH AND HUMAN SEXUALITY: Medical, psychological and sexual topics. Over 500 questions, 1 diskette, $19.95. ESP TRIVIA: Psychic phenomena and more. Over 500 questions, 1 diskette, $19.95. Presented in multipie choice and multi-player game formats. Requires Apple II +, *//e*, *//c* 128K), IBM PC/XT/jr 128K, PC DOS 1.0 to 2.1. or Commodore 64. SPECIAL OFFER: All 6 of the above trivia products, over 6,000 questions, 7 diskettes, $99.95. ***BONUS***: All purchasers of any SUPER trivia product before 1/31/86 will be invited to participate in a FREE TRIVIA CONTEST with over $1,000 in prizes. The Apple 128K version was reviewed with 12 other Apple trivia games and received a **** rating in the 4/85 Software UPDATE: ". . . if you like the elements of a board game, we think SUPER TRIVIA is definitely your best bet . . . it is especially well suited for youngsters and adults to play together." MC/VISA accepted. Network Services, 1915 Huguenot Road, Richmond, VA 23235 (804) 379-2253.

PERFECTCOPY—Fast, easy-to-use copy program with option to password protect your diskettes. Creates Pascal, DOS 3.3 and ProDOS data diskettes. Requires Apple II +, *//e*, *//c* 64K, 1 drive, $29.95 MC/VISA accepted. Network Services, 1915 Huguenot Road, Richmond, VA 23235 (804) 379-2253.

TEACHERS, TRAINERS, PARENTS. . . ANYONE WITH SOMETHING TO TEACH -Develop CAI (computer assisted instruction) with MINI.CAI and your word processor. MINI.CAI takes your textfiles, presents content as screens, gets and analyzes answers. Handles fill-in, matching, multiple-choice, and more. Does full branching, even multi-disk lessons and courses! Programming knowledge not required. Copyable, samples, demo/tutorial. MINI.CAI for Apple II series DOS 3.3 or ProDOS—specify which. Full system, $29.50. Advanced features, program/lesson clearinghouse, newsletter, updates with optional $20 registration. Jerry Muelver, 3568 S. First St., Milwaukee, WI 53207.

GENERAL CONTRACTORS—Get your project bidding and concrete figuring templates here. Runs on Visicalc, Magicalc, and compatibles. Also for AppleWorks. Send $29.95 plus applicable tax to Sackett Ent. 13033 Occidental S., Seattle, WA 98168.

FREE SAMPLES—Our DISK INVOICE SYSTEM (Apple INV/AR package), is perfect for any small business. Only $55.00 COMPLETE! Reliable, tested, unparalleled. Effortless to learn, simple to use. Two disks, excellent documentation. Extremely friendly, thoroughly professional and USEFUL! Why pay more? Write: BROADWAY SOFTWARE, Suite 136, 660 Amsterdam, New York, NY 10025.

DON LANCASTER'S TOOLKITS—Sixteen disk sides chock full of AppleWriter goodies: patches, sourcecode, Diablo microjustify, proportional space, disassembly script, answers, self-prompting glossaries, bonus book, bunches more. AWIIe or ProDOS 2.0 kits, $39.50 each, $59.50 for both. SYNERGETICS, Box 809-NB, Thatcher, AZ 85552. VISA/MC accepted. (602) 428-4073 (8 disk sides per kit.)

ABSOLUTE *//e-//c* RESET—To the "old" monitor ROM. Don Lancaster puts you back in total control. Capture routines, source code, detailed instructions, bonus book, $19.95.SYNERGETICS, Box 809-NB, Thatcher, AZ, 85552. Visa/MC accepted. (602) 428-4073.

$8 (U.S.) INCLUDING DISK—Over 1000 famous business, education, and game programs for II, *//e*. Details: $1 (U.S.) to Reliant, P.O. Box 33610, Sheungwan, Hong Kong.

RENT SOFTWARE $5 MONTHLY—No membership fee. Send large $.39 SASE: Preowned software, 4229 Baker Ave NW, Seattle WA 98107 for List.

WE'LL DRIVE YOUR PLOTTER WILD—The DGI TYPE SHOP will turn your Apple computer and Hewlett-Packard or compatible plotter into a desktop publishing system. Price $175, additional fonts are $25 each. For additional information contact: Decision Graphics, Inc., P.O. Box 2776-CA, Littleton, CO, 80161 (303) 796-0341.

APPLEWRITER *//e* USERS—"AppleWriter Enhancer" is a collection of Powerful WPL programs that tremendously simplify AppleWriter usage. Developed for needs of small office. DOS commands from SCROLLABLE CATALOG; load files from SCROLLABLE CATALOG; on-line CALCULATOR for simple calculations; determine FREE DISK SPACE; AUTOPRINTING ROUTINE to avoid constant changing of print destination; ALPHABETIZING ROUTINE to simplify proof reading; plus others. AppleWriter is one of the most powerful word processors around, and with AppleWriter Enhancer, it is as full-featured as some of the most exotic packages now being marketed. Specify DOS 3.3 or ProDOS. Send $34.95 to: MIC, Route 1, Box 235-A, Kent, CT 06757.

CYCLE ANALYSIS AND FORECASTS—Weekly stockmarket timing service for stocks, options, mutual funds. Advanced methods including computerized models and artificial intelligence. 6 months, 24 issues $50. R.C. Wood, 7616 Burford Drive, McLean, VA 22102.

THE LOST ARK OF THE COVENANT—an all -new machine language hi-res adventure game for the Apple II, II +, *//e*, *//c* with one drive (3.3 DOS). This adventure has won a gold medal in a Long Island Computer Show, and includes graphics routines from Penguin Software's Graphics Magician. With over 150 hi-res images, you can explore tombs, jungles, subterranean complexes, deserts and other enchanted terrains. This two-diskette adventure has taken over three years to create and can be yours for only $12.95, with no postage charge! Send check or m/o to MICOSCAN, 1384 Lyon Place, Wantagh, NY 11793. Include $2 if you want hint sheets and a map of the 100 location adventure. Call (515) 826-5807 for more information.

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ELECTRONIC DRAFTKIT—Hi-res drawing program for the Apple II+, //e, and //c. For drawing electronic circuit schematics, printed circuit board layouts, architectural drawings, etc. 48 shapes and 2 font tables in memory at once. Work area is 2 ⅔ screens large. Rough/fine move, rough/fine four way scroll, draw/erase/rotate, plot/erase lines, type on draft-board (all ASCII characters: rotate, erase, inverse print). Fully menu driven (main, plot mode, typing mode, and DOS menus in memory and instantly available). Save/load/print pictures, change fonts. Main program in machine language, screen dump commands in BASIC, source code for several total picture printer dump routines provided (Epson, NEC printers—Grappler, Microtek, Apricorn interface cards). $28 (S & H included). R. J. Rowley, 1212 E. Del Rio Dr., Tempe, AZ 85282.

USE APPLE II BASIC PROGRAMS?—If so, then you owe yourself a look at DataChief, powerful, easy-to-use, data saving and loading software. Complete DataChief package $18. Demo Disk and manual $9. Manual alone $4. DataChief, 5408 Simmons Dr., Lumberton NC, 28358 (919) 738-7834.

EXPENSE MANAGER—Customizable travel expense record keeping system and report writer. Produces tax-saving summary and reports and can be used to manage up to $1,000,000 and 1,000 accounts. Requires Apple II+, //e, //c 64K, 1 drive, 80 column card or IBM PC/XT/jr 128K, PC DOS 1.0 to 2.1. $39.95 MC/VISA accepted. Network Services, 1915 Huguenot Road, Richmond, VA 23235 (804) 379-2253.

THE COMPLETE I CHING—by Khigh Alx Dhiegh, Ph.D. author of the book, I Ching: Taoist Book of Days. A sophisticated, computerized version of I Ching with the entire text on diskette. Requires Apple II+, //e, //c (64K, 1 drive). IBM and C64 versions available Fall 85. $39.95 MC/VISA accepted. Network Services, 1915 Huguenot Road, Richmond, VA 23235 (804) 379-2253.

EDUCATIONAL SOFTWARE—Three learning tools, 1) Mental Math: 8 math programs, 2) Word Wizardry: 6 language arts programs, 3) Typing Trainer: 4 typing programs. Each system $24.95. Text editor to create your own lessons with Word Wizardry and Typing Trainer also available, $24.95. Requires Apple II+, //e, //c (48K, 1 drive). MC/VISA accepted. Network Services, 1915 Huguenot Road, Richmond, VA 23235 (804) 379-2253.

WORD PROCESSOR—Powerful word processing system similiar to those on many mainframes. Works with 40 and 80 column screens. Preview before printing. Complete system includes Apple PASCAL SOURCE CODE. $39.95 Requires Apple II+, //e, //c (48K, 1 drive). MC/VISA accepted. Network Services, 1915 Huguenot Road, Richmond, VA 23235 (804) 379-2253.

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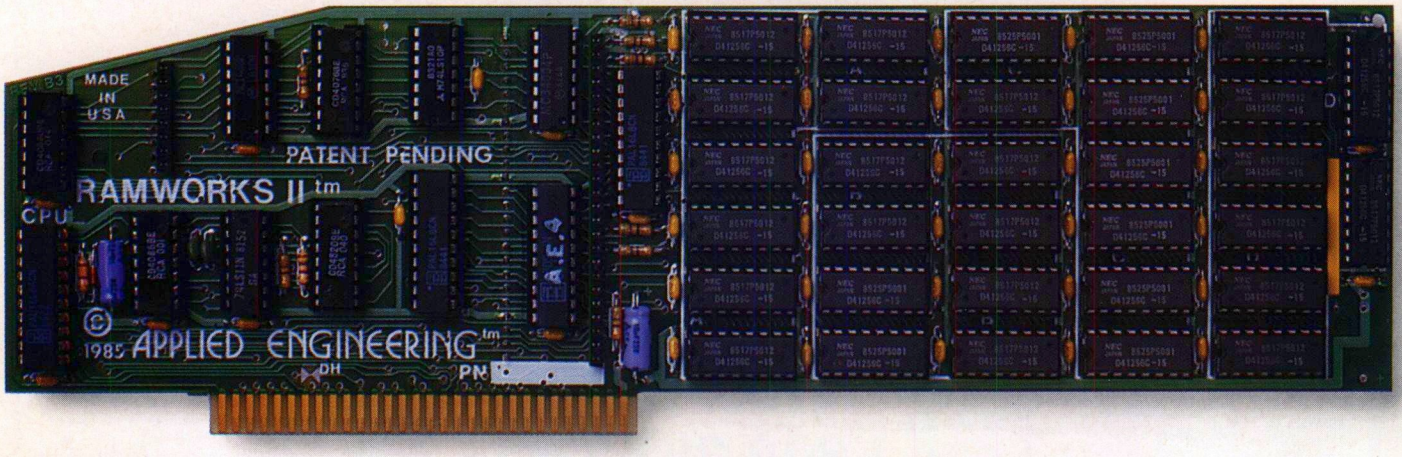

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Turbo Charged AppleWorks.

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RamWorks II	AppleWorks Desktop
128K	101K
256K	183K
512K	367K
1 MEG	736K
1.5 MEG	1104K
3 MEG	2205K

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RamWorks II is compatible with more off-the-shelf software than any other RAM card. Popular programs like Advanced VisiCalc, Magic Office System, Flashcalc, The Spread Sheet, Diversi-DOS, Supercalc 3A, Magicalc, etc. (and hardware add-ons like Profile and Sider hard disks). Fact is, only RamWorks is 100% compatible with all software written for the Apple 80 column and extended 80 column cards. In addition, RamWorks II can emulate most other RAM cards, so you can use programs written for them without modification. And any size RamWorks II can be user upgraded later to any larger size.

RamWorks II was designed so you could take full advantage of future developments in 16 and 32 bit microprocessors. As your needs grow, so can RamWorks II. A handy coprocessor connector allows the latest and greatest coprocessor cards to access all 3 MEG

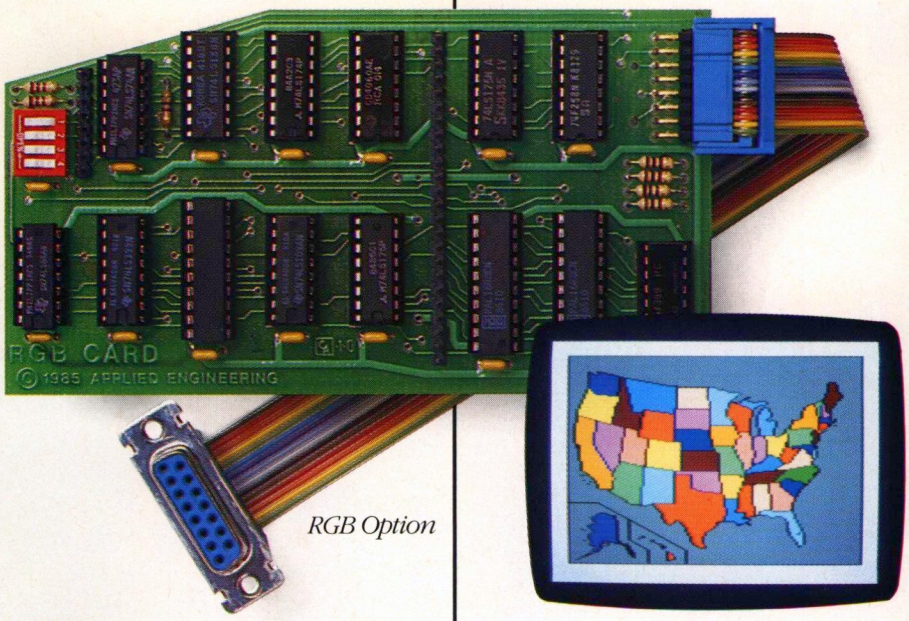
Circle 58 on Reader Service Card

of RamWorks II memory. And speaking of more memory, RamWorks II has a memory expansion connector on board so a low profile (no slot 1 interference) memory expansion card can add another 512K or 2 MEG of memory.

Should you ever run low on memory with RamWorks II (unlikely) you can add these expander cards to your RamWorks II at any time. And of course, these expander cards are compatible with original RamWorks too.

It's In Color.

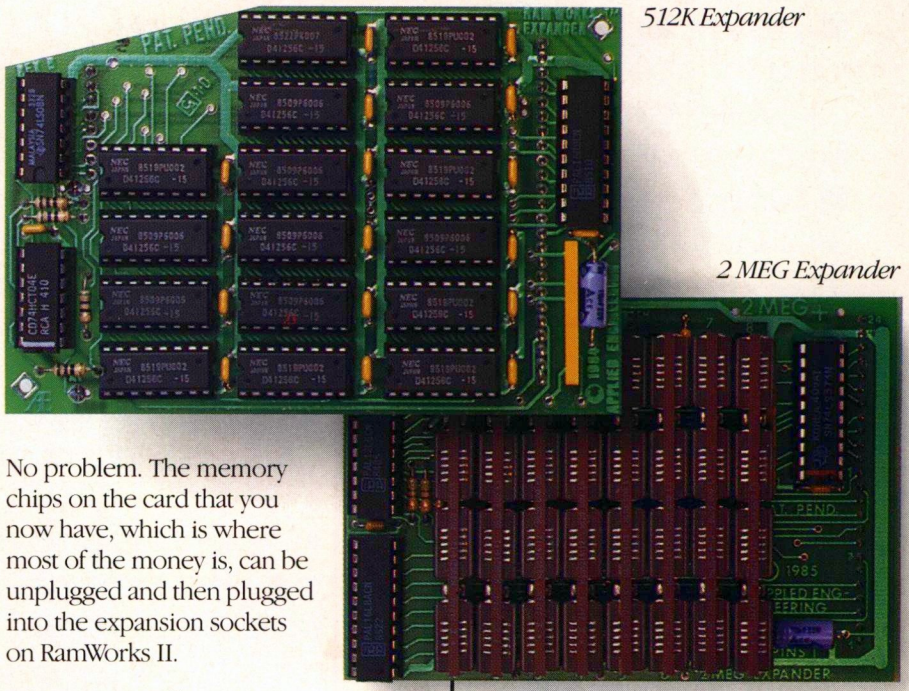
The same slot that's used for memory expansion is also the slot that's used for RGB color display. RamWorks II lets you decide later to add RGB color. For only $129, an RGB option can be added to RamWorks II to give you double high resolution color graphics and 80 column text. All with razor sharp, vivid brilliance that's unsurpassed in the industry. The RGB option does not waste another valuable slot, but rather plugs into the back of RamWorks II with no slot 1 interference (works on the original RamWorks, too) and attaches to any Apple compatible monitor. And remember. You can order the RGB option with your RamWorks II. Or add it on at a later date.



RGB Option

It Corrects Mistakes.

Let's say you bought some other RAM card (and that's a mistake) and your RAM card is not being recognized by AppleWorks, Advanced Visicalc, Flashcalc, Supercalc 3A, or other programs, and you want RamWorks II.



512K Expander

2 MEG Expander

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